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**LA THÈSE A ÉTÉ
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AGE DIFFERENCES
IN
RECALL OF
MEANINGFUL STIMULI

by

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Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Graduate Studies
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ABSTRACT

The purpose of the present research was to investigate the effects of meaningfulness of stimulus phrases and orienting task conditions on free recall performance of older and younger adults in an incidental learning paradigm. It was expected that orienting tasks might affect the depth of processing, while meaningfulness would influence the spread of encoding. It was hypothesized that variables assumed to affect depth and elaborateness of semantic processing might also affect the direction of recall differences between older and younger adults.

Two studies were designed to evaluate the proposed hypotheses. In the first study, meaningfulness ratings were collected. Meaningfulness was defined in terms of the personal relevance of a series of phrases for older and younger adults. Thirty younger and thirty older adult subjects rated a series of 80 phrases for their meaningfulness. Examples included, "Making adjustments to cope with retirement" and "Practice teaching to fulfill course requirements". Subjects rated the phrases on a scale of "1" (Very Personally Irrelevant) to "7" (Very Personally Relevant).

Based on various selection criteria, 4 sets of phrases were designated as differentially meaningful (i.e.,

personally relevant) to older and younger adults. These were items high in meaningfulness (personal relevance) for older adults (HL) while relatively low on this dimension for younger adults, phrases relatively high in meaningfulness for younger adults while relatively low on this dimension for older adults (LH), phrases relatively high in meaningfulness for both older and younger adults (HH), and phrases relatively low on this dimension for both older and younger adults (LL). From these sets, a list of 40 stimulus phrases was selected for use in the second study.

The main study investigated free recall performance of 48 older and 48 younger adult subjects in a levels of processing paradigm. One-third of the subjects in each age group were assigned to a semantic, self-referent rating condition. Another one-third in each age group were assigned to a semantic, pleasant-unpleasant rating condition. The remaining one-third in each age group were assigned to a structural processing task condition. This task required subjects to report the presence of spelling errors in the words of the phrases. Following each of the three orienting task conditions, subjects were given a free recall task for the phrases presented in the stimulus list.

The results indicated that both younger and older adults had higher recall for stimulus phrases that were specifically meaningful to their age group. In each task

condition, older adults recalled significantly more HL phrasetypes than younger adults while younger adults recalled significantly more LH-phrasetypes than older adults. Thus, older adults showed higher recall than younger adults for phrases that were more meaningful to them. Also, following each orienting task condition, no differences in recall of HH or LL phrasetypes between older and younger adults were obtained.

The results suggested that the usually obtained age-related differences in free recall memory performance following semantic processing favouring younger adults, can be reversed. It was concluded that under appropriate conditions, older adults can process stimulus information to deep, "meaning" levels.

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CHAPTER 1

Levels of Processing Framework

The conception of the human brain as an information processing system is based on an analogy drawn between the functioning of the brain and the functioning of computers. With the adoption of the computer metaphor in psychology, the view of man changed from that of a passive receiver of information to that of an active processor of information (Miller, 1956; Broadbent, 1958).

Two major phases in the evolution of the information processing framework can be noted. One phase applies to the stage models of memory, while the second applies to the levels of processing models. The multistage accounts of memory (e.g., Atkinson and Shiffrin, 1968; Waugh and Norman, 1965), draw a distinction between a short-term or primary memory and a long-term or secondary memory. In addition, sensory stores (e.g., Sperling, 1960) of a modality-specific nature are assumed to precede these two memory stores in the processing sequence. Examples of such stores include iconic memory (Neisser, 1967) in the visual system and pre-categorical acoustic storage (Crowder and Morton, 1969) in the auditory system.

Many current models of human memory are dominated by the concept of stores and the transfer of information among them. According to multistore theories, memory stores differ essentially on three basic dimensions or criteria. These are their capacity, coding and forgetting or retention features (Baddeley, 1978). The various features or properties of these stores, as well as evidence for the distinction among them, have been derived from various models (e.g., Murdock, 1967; Atkinson and Shiffrin, 1968).

As an alternative to the various stage models, Craik and Lockhart (1972) proposed a "levels of processing" model of human memory. Their approach retains a dichotomy between primary, or short-term memory and long-term or secondary memory. However the emphasis is changed from a "structural" to a more "process" oriented approach; from an approach in which separate stores are postulated to have different coding processes to one in which coding itself is the most important variable.

This conceptualization is based on the assumption that words are represented in memory as features or attributes (e.g., Bower, 1967; Underwood, 1969). Features are viewed as theoretical values on various qualitatively distinct dimensions. For example, three dimensions, orthographic, phonemic, and semantic are assumed to combine to specify a particular word. The orthographic and phonemic dimensions represent the visual and auditory properties of a word.

The semantic dimension represents the more abstract properties of conceptual meaning. Since the orthographic and phonemic dimensions refer to physical characteristics of a word, these features contribute no semantic information to its lexical representation (Hunt and Elliott, 1980).

This approach views the external physical stimulus as a multidimensional event whose internal representation may consist only of some subset of the features defining the physical stimulus. The orienting (processing) response is assumed to influence the selection of encoded attributes. Within this framework, the memory trace (in the form of extracted features) is viewed as a by-product of perceptual analyses.

According to the original levels of processing formulation, the essence of this approach involved the notion that the learning of anything requires a series of processing stages. Such perceptual processing was viewed as progressing along a continuum of depth, arranged in a hierarchical series, from shallow sensory and phonemic levels to deeper, semantic levels. The subsequent memory of an event is assumed to be determined by the degree of "depth" to which input information is analyzed.

The hypothesized stages of processing were the following: In the initial stages of perceptual processing, stimuli would be analyzed for their gross physical features

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such as lines, contours, and angles. At the next level of processing, information is stored in memory and the new information is matched against existing stored representations; at this level, then, the recognition process occurs. After a stimulus is recognized it may be further processed and elaborated by association and integrated with existing information stored in long-term memory. This final stage requires that information be organized into semantic memory, or memory for words and meaningful information. For example, after a word is recognized it may evoke associations, images or stories, on the basis of a subject's past experience with the word. Thus the entire process of placing information in memory involves a series of stages with information being processed to progressively greater depths as orthographic, lexical, acoustic and semantic features of stimuli are processed.

In general, factors such as the amount of attention paid to a stimulus, its compatibility with analyzing cognitive structures and processing time available are assumed to determine the depth to which a stimulus is processed. For example, the levels of processing framework (Craik and Lockhart, 1972) postulates that since highly familiar, meaningful stimuli (i.e., such as pictures or sentences) are compatible, by definition, with existing cognitive structures, they will be processed to a deep level more rapidly than less meaningful stimuli, and will

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be well retained. Amount of retention is viewed as a function of the extent to which a person has developed cognitive systems to analyze and enrich particular type of stimuli. That is, retention will depend on the familiarity, compatibility and meaningfulness of the material being studied. This particular aspect of the theory will be discussed in a later section as a testable hypothesis, involving comparison of memory performance of older and younger adult subjects.

Depth of processing has proven to be an evolving concept and has continued to be modified and extended (Craik and Tulving, 1975; Jacoby and Craik, 1979; Lockhart, Craik and Jacoby, 1976). In their original formulation, Craik and Lockhart (1972) conceived of the cognitive system as analyzing stimuli in a fixed-order, "bottom-up" manner, from shallow to deep levels. The idea was that stimuli would be processed or analyzed through intervening levels to reach deep levels. Currently, this view has shifted to accommodate notions of a more flexible, interactive system (Craik, 1979; Kintsch, 1979; Eysenck, 1979). That is, both "bottom-up" sensory to semantic processing, and "top-down", schema-driven processing can occur to facilitate and direct perception and comprehension (Masson and Sala, 1978; Craik and Simon, 1980). Thus, although levels of analysis can be ordered logically from shallow to deep, the processing sequence itself is viewed as reflecting interactions and recursive operations among

the various levels and types of representations. The memory trace is still conceptualized as the record of pattern analyzing operations which depend primarily on task demands. However, the current view claims that previous learning, in the form of expectations or "schema" can interact with current sensory input to give rise to perception and understanding (Craik and Simon, 1980).

In more recent versions of the model, the notion of trace durability has also been revised (e.g., Fisher and Craik, 1977; Jacoby and Craik, 1979). Craik and Lockhart (1972) originally proposed that the more deeply encoded traces decayed less rapidly than traces encoded at a shallow level. Jacoby and Craik (1979) have since suggested that deeper encodings are not more durable than shallow encodings, but instead, are more discriminable from other memory traces. The revised model still retains the concept of different levels or domains of processing. That is, it assumes a qualitative distinction between semantic and nonsemantic analyzing operation (Moeser, 1983).

Experimental Evidence: Depth of Processing

Many incidental learning studies (e.g., Hyde and Jenkins, 1969; 1973; Johnston and Jenkins, 1971; Till and Jenkins, 1973; Walsh and Jenkins, 1973) have been interpreted within the levels of processing framework.

These studies have demonstrated that deeper, semantic processing results in better retention, than shallow or phonemic encoding of stimulus information.

Walsh and Jenkins (1973) examined the role of "incidental learning" instructions on memory for lists of words. The usual procedure involved giving different groups of subjects one of several kinds of instructions before they were read a list of words to be remembered. The various sets of instructions served as different orienting tasks for learning the list of words. One group of subjects was required to indicate whether or not each word contained the letter "e" as the words were read aloud. Another group of subjects was asked to estimate the number of letters in each word, and a third group was instructed to rate each word, on a scale of "pleasantness" to "unpleasantness". In addition, an "intentional learning" control group was simply instructed to learn the words and to try to remember them. At the end of this phase all subjects were asked to recall the words from the list. Subjects in the incidental learning groups, thus, were unexpectedly given a retention test.

It was found that subjects who rated each word on the "pleasantness-unpleasantness" scale had superior recall to subjects who engaged in counting the number of "e's", or the number of letters in the stimulus words. This finding is consistent with predictions which can be derived from a

levels of processing viewpoint. The results were interpreted as suggesting that orienting instructions influenced the level at which words were processed. The assumption underlying this is that instructions to count the number of "e's" in a word or to count the number of letters in a word, would tend to restrict processing of these items at a shallow, superficial level, that is, treating them as nonmeaningful elements. Instructions to rate words on a scale of "pleasantness" to "unpleasantness" would involve processing words at a semantic level, that is, treating them as meaningful units.

The authors reasoned that, if for example, a subject is asked whether the word "table" is pleasant or unpleasant, or whether the word table has an "e" in it, the following processes would most likely be involved: In the first case, one would access knowledge of what the word "table" means and evaluate that knowledge against the pleasant-unpleasant dimension. In the second case, one would recall the spelling of the word and decide whether it contained an "e". The first task is seen as activating the semantics of table whereas the second task need not. To the extent that recall processes normally depend on semantics, the first task is considered to lead to better recall performance.

Studies (i.e., Johnston and Jenkins, 1971) employing other types of semantic tasks, such as an adjective-noun

task, which required subjects to generate appropriate adjectives to modify stimulus nouns, or more superficial orienting tasks, such as a phonemic or rhyming task, which required subjects to state words that rhyme with given stimulus words, found similar results. Subjects instructed to perform semantic orienting tasks showed superior retention to those required to perform more superficial orienting tasks such as the rhyming task. This latter task was construed as inhibiting assignment of meaning to words.

Types of nonsemantic orienting tasks used in studies of incidental memory that support levels of processing, include counting the number of a specified letter contained in each word, making word or syllable length judgements, indicating the sex of the speaker, judging the type case of words and attending to the location of the tongue as a word is pronounced (i.e., Seamon and Murray, 1976).

Various experiments (e.g., Hyde and Jenkins, 1969; 1973; Johnston and Jenkins, 1971; Hyde, 1973) utilized conditions in which a subject knew he would be required to recall words (standard free recall paradigm) as well as conditions in which a subject was not forewarned about a recall task (standard incidental learning paradigm). In general, the intention-to-learn dimension produced very little difference in either recall or associative structure, and the effects of various semantic and nonsemantic tasks were relatively constant across the

intentionality dimension. In addition, experiments involving incidental learning of sentences (Bobrow and Bower, 1969; Rosenberg and Schiller, 1971) have also shown that recall following an orienting task that required processing sentences to a semantic level, was substantially superior to recall of sentences which were processed nonsemantically.

An important characteristic of the incidental learning paradigm is that it is assumed that a subject will process stimulus material in a way compatible with or determined by an orienting task. A comparison of retention across different orienting tasks, therefore, provides a measure of the memorial consequences of different processing activities under incidental conditions. The experimenter has control over the processing a subject applies to stimulus material that he does not have when a subject is instructed to "learn" and uses an unknown coding strategy (Craik and Lockhart, 1972).

It has been demonstrated that deeper, semantic processing of stimulus information tested for immediate recall results in good retention (Craik and Tulving, 1975; Jenkins, 1974; Craik, 1973; McDaniel and Masson, 1977). The effect is attributed to the qualitative nature of the underlying processing (i.e., the degree of depth) and not to other factors such as time (Craik and Tulving, 1975; Walsh and Jenkins, 1973), effort (Walsh and Jenkins, 1973)

or even intention to learn (Craik, 1973; Hyde and Jenkins, 1973; Postman, 1964).

Experimental Evidence: Elaboration or Spread of Encoding

On the basis of later research, (e.g., Craik and Tulving, 1975), the concept of elaboration or spread of encoding was incorporated into the levels of processing framework to account for differences in retention observed at a given depth or level of encoding. Whereas "depth" refers to differences in qualitative types of analyses and memory codes, "elaboration" refers to the extensiveness, richness or amount of processing carried out at any level of depth (Anderson and Reder, 1979).

An inconsistency between depth theory and experimental evidence was noted by Craik and Tulving (1975, Experiment VII). Subjects in this experiment were given a variety of orienting tasks, all involving semantic analysis of target words. These researchers used the technique of asking subjects to indicate whether a tachistoscopically presented word fitted a given sentence. The sentence contexts of the target words ranged from the simple (e.g., "He dropped the ___") to the complex (e.g., "The old man hobbled across the room and picked up the valuable ___ from the mahogany table").

Considerable differences in free recall as a function of orienting tasks were found. The percentage correct recall ranged from twenty per cent to over eighty percent under different conditions. Specifically, it was found that greater sentence complexity increased cued recall of target words when the target items fit the sentence (i.e., were congruous) but did not when the target words did not fit the sentence. These findings were interpreted by Craik and Tulving (1975) as evidence that retention is a function of both the depth to which information has been processed and of the spread or elaboration of encoding at a particular level.

Frase and Kamman's (1974) study has also been viewed as providing experimental evidence for the concept of elaboration. In this study, subjects determined whether words belonged to a designated category. Different subjects were presented categories varying in degrees of specificity (e.g., food versus vegetable). It was assumed that in order to complete the task, subjects in the different groups would process the target items to the same deep semantic level, but that their processing would differ in the degree of elaboration performed at that "deep" level.

The main finding was that memory performance was higher where more specific category judgements had been made. Perhaps this was so because a greater spread of

processing at the semantic level was involved for these types of judgements.

The importance of spread or elaboration of encoding at the semantic level was also demonstrated in a study by Klein and Saltz (1976). They used semantic tasks which required subjects to rate nouns on various semantic attribute dimensions (e.g., pleasant-unpleasant). These investigators demonstrated that asking subjects to rate words on two uncorrelated semantic dimensions (i.e., pleasant-unpleasant ratings and size dimensions), resulted in higher recall than rating words on either semantic dimension alone, suggesting that greater elaboration for the two-dimension task facilitated memory performance.

Eysenck and Eysenck (1979) also manipulated spread or elaboration of encoding in a similar manner in their study. Elaboration at the physical or shallow level of processing was manipulated by requiring subjects to decide whether the target word contained a single specified letter or whether it contained two specified letters. Elaboration at the semantic level was manipulated by requiring subjects to decide whether the target word referred to something describable by a single semantic term (i.e., "liquid"), or whether it referred to something that could be described by two semantic terms (e.g., liquid and edible).

In a subsequent free recall task it was found that semantic encodings were better recalled than physical

encodings, as is usually found in typical levels of processing studies. It was also found that elaborate encodings showed superior recall to nonelaborate encodings.

Thus, based on additional research from the levels of processing paradigm (Craik and Tulving, 1975), differences in retention were no longer explained purely in terms of depth of processing. An additional mechanism was proposed, suggesting that processing differs in breadth or degree of elaboration as well as in depth, thereby allowing an account of differences in retention that arise within a level of processing. Craik and Simon (1980) have pointed out for example, that certain tasks, such as proofreading or colour matching would require rather extensive processing at shallow levels. Other tasks such as reading for meaning, however, would require minimal sensory analysis, but more extensive deep elaborative processing.

Criticisms of the Depth of Processing Model

Two main issues will be discussed in this section. One is the quantitative versus qualitative distinction in memory codes specified by the levels of processing approach. The other, is the problem of an independent measure for a depth of processing.

Quantitative Versus Qualitative Distinction. Arbuckle and Katz (1976) pointed out that different orienting tasks may not induce qualitatively different memory codes but rather a nonsemantic orienting task may simply yield a weaker semantic trace, suggesting a quantitative difference. Craik (1979) however, has suggested that this possibility ~~seems~~ unlikely given the demonstration of encoding specificity by Tulving and his colleagues (Tulving and Thomson, 1973). These experimenters have shown that the effectiveness of a particular type of retrieval cue is strongly dependent on the type of encoding induced at input. That is, differences in encoding processes yield correlated differences in the resulting memory traces. These findings appear to support the notion of qualitatively different codes (Fisher and Craik, 1977; Tulving, 1979).

Morris, Bransford and Franks (1977) found that recognition performance depended on the type of test given the subjects, rather than on the level of orienting task. That is, although semantic questions produced superior performance on a standard type of semantic recognition test, rhyming questions produced better performance on a rhyming recognition test. Similar findings have been reported by Fisher and Craik (1977). Fisher and Craik claim, however, that even when the appropriate retrieval test is given, performance in semantic conditions is superior to performance in nonsemantic conditions.

Consequently, they state that it is still necessary to retain the concept of different levels of processing to explain qualitative differences between semantic and nonsemantic orienting tasks.

Independent Measure of Depth. One major weakness in the levels of processing approach, which has been noted by many investigators (Craik, 1977; Baddeley, 1978; Nelson, 1977; Eysenck, 1978), is the inherent circularity involved in the notion of "depth". As Eysenck (1978) correctly points out, one major limitation on the concept of "depth" or "level" of processing is the absence of an independent index or measure of depth. In the absence of such an index there is an obvious danger of circularity in the descriptive logic. This can lead to defining depth as the type of processing that leads to high retention levels, and to give "deeper processing" as the answer to the question of why some events are well remembered.

Initially, it was suggested (e.g., Craik and Lockhart, 1972; Craik, 1973; Craik and Tulving, 1975) that it might be possible to define depth in terms of the processing time to complete various classification tasks. This was based on the assumption that the deeper the analysis, the longer it would take to carry it out. For example, Craik and Lockhart (1972) hypothesized that a semantic classification

task (i.e., deeper analysis) might take more time, and hence, be deeper than a phonemic or structural classification task (i.e., superficial analyses).

Subsequent research (Craik, 1973; Gardiner, 1974; MacLeod, 1976; Craik and Tulving, 1975) has shown that time per se, cannot be a general indicator of processing depth. Craik and Tulving (1975, Experiment V) demonstrated that although a structural task took longer to complete than a semantic task, the "deeper", semantic task resulted in higher levels of recognition performance.

Craik and Lockhart's (1972) definition for an ordering of depth of processing is in terms of the type of analysis conducted at stimulus input. Semantic processing of a stimulus input, which leads to consideration of its meaning, is assumed to be "deeper" than nonsemantic processing, which focuses on the sensory, physical, or phonemic features of a stimulus. This definition arose subsequent to the finding that semantic classifications facilitate memory performance more than structural classifications (e.g., Hyde and Jenkins, 1969). In practice, the major qualitative distinctions between semantic and nonsemantic tasks, employed in incidental or intentional learning paradigms, have been generally accepted (e.g., Craik and Lockhart, 1972; Baddeley, 1978; Glanzer and Koppenaal, 1977) as an adequate operational definition of a learner's depth of processing.

CHAPTER II

An Application of the Level of Processing Framework to Aging Research

One important psychological aspect of adult human aging is an apparent decline in learning and memory functions with increasing years. The main aim of research investigating relations between aging and memory has been to determine what mechanism or mechanisms in the memory process are responsible for the observed age-related decrements in memory performance. Studies in regard to this question usually employ the cross-sectional method, comparing performances of subjects in different age groups. The use of this method has resulted in research findings that describe age differences rather than age changes. One potential problem inherent in this method is that it may confound age differences with cohort or generational differences.

Many of the concepts, paradigms and procedures in the mainstream of memory research have been directly applied to the study of memory and aging. This has been especially true since the late 1950's, with the adoption of an information processing approach to the study of memory.

Thus, theoretical enquiries about the identity of age-related memory deficits have developed in conjunction with theoretical and empirical developments of models of human memory.

Early studies within a pre-information processing framework investigated age differences in an incidental learning paradigm. Some studies reported an age-related decrement in incidental learning (e.g., Bromley, 1958; Kausler and Lair, 1965; Willoughby, 1929; 1930; Farrimond, 1968; Peak, 1968), other studies (e.g., Hulicka, 1965; Wimer, 1960) did not.

One comment that can be made about pre-information processing studies investigating age differences in incidental learning, is that they did not instruct subjects to perform operations on stimuli that were later tested for incidental learning. Thus, one cannot be sure whether older subjects treated this material in the same way as younger subjects. Since very little experimental control over the nature and extent of a subject's contact with incidental material was exerted in most of these studies, factors leading to the presence of age-related decrements in incidental learning are unclear.

One advantage of the levels of processing framework, however, is that incidental orienting tasks instruct subjects to deal with presented material in a specific way. Tasks which involve a subject with phonemic or orthographic

characteristics, are assumed to hold perceptual processing of stimuli at shallow levels, while tasks involving, meanings of words are assumed to induce processing to deeper, semantic levels. This experimental and theoretical paradigm offers interesting possible ways to approach the study of age differences in memory.

One hypothesis stemming from the levels of processing approach is that older adults do not spontaneously process information as deeply or elaborately, that is, to "meaning" levels as younger subjects do (Hartley, Harker, and Walsh, 1980). When instructed to "learn" stimulus items in an intentional learning paradigm, older adults seem to be at the greatest disadvantage because they are less likely to engage in elaborate, semantic processing. Thus, it was expected that the specific requirements of a semantic orienting task would be effective in reducing age differences in recall.

However, the general pattern of results of such research (Walsh, 1975; Eysenck, 1974; White and Craik, cited in Craik, 1977; Perlmutter, 1978; 1979; Zelinski, Walsh and Thompson; 1978), is that although older adults typically recall more stimulus items following semantic than nonsemantic tasks, differences in free recall between older and younger adults are generally greater following semantic orienting tasks (i.e., deep level processing) than nonsemantic tasks (i.e., shallow level processing). This

observed failure of older adults to process information as deeply and elaborately as younger adults, has been called a "processing deficit" by Eysenck (1974). The results suggest that older adults, compared to younger adults, are less able to make effective use of semantic processing strategies.

Eysenck (1974) tested the processing deficiency hypothesis by giving old (55-65 years of age) and young (18-30 years of age) subjects one of four orienting tasks to perform on items in a list of nouns. Two required "meaningful" processing of stimulus words and two "nonmeaningful" processing. Subjects in these conditions were not informed that they would be subsequently asked to recall the presented words.

The incidental orienting tasks were assumed to control "levels of encoding". The two meaningful processing tasks required subjects to state adjectives to describe stimulus nouns, or to form an image of the referent of a given stimulus word. The two shallow processing tasks consisted of counting the number of letters in stimulus words, and generating words that rhymed with given stimulus words. In addition, a control group was simply instructed to learn the list of words. All groups were subsequently asked to free recall the words. Eysenck (1974) predicted that age differences in recall performance would be greatest following deep, semantic processing of information.

It was found that in both age groups, semantic processing tasks led to much greater recall and organization of recall than nonsemantic orienting tasks. Older subjects, however, recalled significantly fewer words than younger adults when both groups had performed "meaningful" processing during the orienting tasks. There were no differences in recall between old and young adult subjects in the nonmeaningful orienting task conditions. In the intentional learning group, older subjects showed the greatest decrement in recall, compared to younger adults. According to Eysenck, this latter result strongly implied that under standard intentional learning conditions, older subjects do not spontaneously employ deeper levels of processing relative to younger subjects. Eysenck (1974) interpreted the results of this study as support for a processing deficit explanation of age differences in memory. That is, memory failures in the elderly are due to a failure of older subjects to encode stimulus material to deep, "meaning" levels.

In a study by Walsh (1975), memory performance of three groups of older subjects (60-75 years) was compared to three groups of young subjects (18-25 years). One group within each age level was instructed to perform an orienting task requiring "meaningful" processing (i.e., rating each word as pleasant or unpleasant) of a list of 27 paired associate words. Another group within each age level was required to perform an orienting task which did

not require meaningful processing of the stimulus list (i.e., estimating the number of "e's" in words) and a third group within each age level was given no orienting task and was informed of the recall task that would follow the learning phase.

Walsh (1975) predicted that old adult subjects in the meaningful processing group would perform as well as young adult subjects in this group, as they were both processing stimulus inputs in the same "meaningful" way. It was found however, that old adult subjects were particularly poor at recall, compared to the young, when meaningful processing was required. Recall differences between young and old adult subjects were twice as large following meaningful processing tasks than after nonmeaningful processing tasks. Both age groups did, however, show better recall performance with meaningful processing orienting tasks. Walsh (1975) interpreted these results as suggesting that either older subjects are less able than younger subjects to process stimuli to deep levels or alternatively, that memory traces resulting from processing to deep, "meaning" levels, are less durable for older adults.

A study by Mason (1979) did not find higher recall for older adults following semantic (i.e., a category judgement) processing tasks compared to shallow processing (i.e., case and rhyme) tasks. Also, the level of recall of older adults was lower than that of younger adults.

Although it was concluded that the study supported notions of an age-related processing deficit, Mason (1979) partially attributed the results to the difficulty level of the word list for older adults.

In general, findings of age-related differences in memory performance have been attributed to various factors. One explanation attributes the differences to non-cognitive or performance variables. It has been proposed that because the type of materials usually presented in laboratory investigations are lists of words and nonsense syllables, there may be differences between younger and older adults in their motivational approaches (i.e., Hulicka, 1965; Labouvie-Vief, 1980), and in the experiential bases (i.e., Ferguson, 1954; 1956; Rogers, 1971) involved in the learning of such material. Also, tasks have generally been viewed as more novel and relatively meaningless for older than for younger adults. Another explanation has focused on the differential familiarity or meaningfulness of stimulus material usually employed in investigations of age-related performance differences. It has been suggested that stimuli are usually normalized for younger adults and therefore, may not be equally meaningful or familiar to older adults (e.g., Colby, 1976; Barrett and Wright, 1981). Each of these hypotheses will be briefly elaborated in the next two sections.

Non-Cognitive, Performance Factors

Motivation. Differential levels of motivation for performance in experimental tasks, by young and old adults, has been suggested as contributing to age differences (Hulicka, 1965). A relation between task meaningfulness and willingness to perform on tasks is evident, for example, in studies in which many older subjects simply refused to exert themselves to learn what they considered to be irrelevant experimental tasks (Hulicka and Rust, 1964). Hulicka and Rust (1964) reported age-related deficits in recall scores following a 24-hour retention period. The authors suggested that age-related recall differences obtained in this study could be partly attributable to the type of task, which involved acquisition and retention of nonsense equations (i.e., $E \times Z = G$, or $B \times D = M$). It was observed that during the acquisition phase, younger subjects, much more frequently than older subjects, simplified the task either by ignoring one of the stimulus letters or by attempting to convert nonsense equations into personally meaningful symbols. Thus, in spite of the formal identity of tasks for both groups, younger subjects may have had less, as well as more sequentially organized material to learn and retain.

An important point noted in this study is that old and young adult subjects differed greatly in their motivation for doing the experimental task. Older and younger adults

approached the task with different attitudes. Younger subjects appeared to be willing and determined to perform well, while older subjects indicated that they resented being required to learn such "nonsense". This may well limit the conclusions one can draw about what older adults have actually learned in an experimental task and thus, about differences in learning ability between young and old subjects. The authors noted that if valid comparisons are to be made between age groups for efficiency of learning and recall, experimental tasks should be equally appropriate for older and younger subjects.

Intuitively, it seems reasonable that older subjects should be at less of a disadvantage when stimulus materials to be learned and remembered, are meaningful and familiar to them. Several studies have varied the associative strength of stimulus-response pairs in a paired associate task. The word "table", for example, is considered to be of higher associative strength to "chair", than the word "glove". The pair table-chair is considered to be more familiar and hence more meaningful perhaps because it has been experienced more frequently than the pair "table-glove". Several paired associate learning studies have found that older subjects perform least well with materials of low association strength (Canestrari, 1966; Zaretsky and Halberstam, 1968; Botwinick and Storandt, 1974; Korchin and Basowitz, 1957; Ruch, 1934).

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A study by Hulicka (1965) in which subjects were required to associate names and faces, reported no age-related decrements in recall performance. Hulicka noted that elderly subjects appeared interested in performing the task, and remarked that it made sense to them.

Perlmutter (1978) noted that older subjects may be less tolerant of unfamiliar learning tasks. One part of Perlmutter's study compared memory for relatively meaningless lists of words and more natural, factual information. In the "natural" facts task, subjects were presented with 24 general information fact questions. Subjects were instructed to answer 6 questions involving historical events from 4 equal time periods between 1890 and 1969 and then to make confidence ratings for the accuracy of their responses. In the word recall and recognition tasks, subjects were asked to study a list of 24 words for later recall and recognition.

It was found that, although older subjects performed significantly worse than younger subjects on word recall and recognition, they performed significantly better on fact recall and recognition. This superior performance by older subjects was evident for all time periods and was not greater for questions pertaining to years that only older subjects had lived through. This ruled out an explanation of differences in performance merely on the basis of

differential exposure to particular facts that were tested.

Perlmutter (1978) suggests that older subjects' better memory for facts should set their poorer memory for words in perspective. Although older subjects were evaluated as deteriorating on typical laboratory tasks, they actually performed more competently than younger subjects on more relevant tasks. Thus, the significance of list-learning word memory tasks should be questioned more extensively. Perlmutter also noted that findings from standard laboratory list-learning memory tasks should not be over-generalized. Since many of the laboratory procedures used are not relevant to the personal needs of older subjects, they may not elicit optimal performance from older people.

Schaie (1974) noted that stimulus materials and procedures should be designed to fit the particular needs of older adults, such that materials and instructions are structured in ways that are appropriate for the elderly. This may provide a method of maintaining motivation to participate in experimental tasks among older adults (Kausler, 1982).

Labouvie-Vief (1980) reported that many of the elderly subjects in her studies refused to complete many tasks which they considered to be "useless" activities. Young adult subjects, however, did not express this reluctance. Commenting on research with older adults, Labouvie-Vief

(1980) reports that:

"Many lost interest and dropped out of research, others felt upset and misused; the more assertive and opinionated ones told me that my battery of tasks was altogether unrelated to what they felt should define intelligent behavior...".

The author further notes:

".....What was truly astounding about this observation is that it was practically undocumented in the literature. I set out, therefore, to re-read several key studies between the lines. And indeed in one I learned that older people had simply refused to learn a task which required the pairing of numbers and nonsense syllables and as a result, forced the researchers (Hulicka and Grossman, 1967), to redesign their task so as to deal with more meaningful material;..... it appeared that these older adults had intelligently refused to do what many college students will let themselves be subjected to. And similarly, it appeared that my "own" elderly subjects had demonstrated a kind of intelligent pragmatics on their reaction to the tasks they were asked to do." (pages 6 and 7).

Thus lower learning scores of older subjects in experimental tasks would not necessarily indicate that older adults are less able to learn and remember information. Rather, these scores may simply reflect a lower willingness of older subjects to participate in a task, perhaps because of its meaningless nature and its lack of personal relevance to them.

Experiential. Studies of age-related deficits in secondary memory have usually compared the performances of

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older adults with younger adults who are typically university students. These cross-sectional studies have perhaps, from the outset, been biased in favour of obtaining better performance from younger adults. This seems to be the case for a variety of reasons. The education that older subjects have had is generally less recent. It is possible that younger adults may have certain strategies for learning in the somewhat similar contrived situations of school and laboratory. It is likely that younger subjects have had more and more recent practice with these strategies. Young adults then, are more likely to possess skills and orientations that enable them to deal more effectively with learning situations than old adults who are not in formal learning situations on a daily basis (Sanders, Murphy, Schmitt and Walsh, 1980).

Most experiments have required subjects to learn and remember list of words or nonsense syllables. This is conceivably similar to what a student may do in the normal course of a day, but is not likely to be something an elderly person would undertake. Everyday remembering may not involve the active, strategic encoding emphasized in academic remembering (Smith, 1980). Thus, it may be that if problems and issues relevant to individuals in later life were also employed in such investigations, older adults may be found competent in dealing with situations more meaningful to them and reflecting problems in their world and of concern to them.

Support for this viewpoint is derivable from an experiential framework (e.g., Ferguson, 1954; 1956; Rogers, 1971). This framework views cognitive development after early infancy as a process of transfer from previously acquired knowledge and skills. The theory assumes that as a child develops, the number of skills and amount of knowledge that is acquired gradually increases through a process of positive transfer. That is, aspects of tasks learned in the past are applied to, and facilitate performance and learning of new tasks. This period of cognitive development through positive transfer is viewed as continuing up to late adolescence or early maturity. According to the theory, from this age range onwards, certain skills and response tendencies are used more and more often in the performance of daily activities and become deeply ingrained habits or overlearned ways of responding. Other skills on the other hand, may decline through lack of use and practice. The frequently practiced skills eventually occupy the highest level in an hierarchy of available response tendencies of an older individual.

The experiential framework proposes that these familiar, highly practiced responding tendencies, can, in some situations, be detrimental to learning and performance. For example, when unfamiliar situations arise, an older person may tend to apply familiar, well-developed skills, which may not be particularly appropriate for an efficient solution of a problem.

Furthermore, an older person may be unwilling to abandon familiar skills as they may have frequently proven adequate in the performance of daily activities. The theory postulates that a younger person will have had more recent practice in dealing with novel or unfamiliar situations, and will not have a set of such strongly ingrained response tendencies as an older person.

Thus, with increasing age, there is a tendency to apply familiar, practiced ways of responding in unfamiliar situations. When these well-developed skills and information are inapplicable, an older person must try to use unpracticed skills which may take a long time to redevelop. The "experiential" theory predicts that older people should perform less efficiently than younger people, on unfamiliar novel tasks. Ruch (1934) for example, found greater age decrements in a task involving learning of nonsense equation (i.e., $E \times Z = G$).

Fozard and Thomas (1975) have noted that older subjects claim that one strategy they have acquired with age is to be quite selective about what they bother to learn. If this is the case, then the typically "useless" information presented to subjects in the laboratory (i.e., lists of words and nonsense syllable) may be poorly learned because of the generally adaptive habit of attempting to learn only that which is meaningful.

Differential Familiarity or Meaningfulness of Stimulus Material

The usually observed age-related decrements in memory performance have also been linked to generational differences in the meaningfulness and usage of words (e.g., Wittels, 1972; Colby, 1976; Poon and Fozard, 1978; Barrett and Wright, 1981; Worden and Sherman-Brown, 1983). Wittels (1972) suggested that typical age-related deficits found in laboratory learning and recall, may be minimized or nonexistent when stimuli are made equally meaningful for all age groups. The assumption underlying this hypothesis was that stimuli used in laboratory studies are culturally or generationally bound. That is, there may exist cultural differences in the association value of words in a learning task. Meanings of words tend to change over time and thus have different generational connotations and usages. Wittels (1972) noted that stimulus materials are usually developed (i.e., normalized) for young adults. Thus, they are likely to be less meaningful or appropriate for older adults.

A study by Colby (1976) found differential recall performance for lists of words normalized on young and old adult subjects. Colby reasoned that high frequency words for younger subjects may not be high frequency words for older subjects. For example, for younger adult subjects, the word "aunt" had the highest frequency count within the

category, "relative". However, perhaps because of a difference in social environment, niece, nephew or grandchild was more likely to be higher in the response hierarchy of older adults. Colby stated that one reason for this is that these latter words may have more relevance to the life of older persons, relative to younger ones.

The results of Colby's (1976) study indicated that for both age groups, recall performance was poorer on age-inappropriate word lists. Colby concluded, on the basis of these results that there may be a methodological artifact (i.e., age-inappropriateness of word lists) in research comparing memory performance of older and younger adults. Use of such inappropriately normalized items for older adults may serve to inflate estimates of memory impairment.

A study by Poon and Fozard (1978) used the concept of "meaningfulness" or familiarity in a similar way, to test the hypothesis that the degree of familiarity of pictured objects would be a major predictor of the time required to retrieve names of pictured objects from long-term memory. Old and young adult subjects were presented four types of pictured objects. One group of pictures consisted of objects used 50 to 70 years ago (i.e., items more familiar to older adults), and another group consisted of objects unique to contemporary times (i.e., items more familiar to younger adults). In addition, other contemporary and dated

pictures of objects, commonly used in both periods, were used. The task was to name each object as quickly as possible.

It was found that names of objects that were relatively more familiar to members of an age cohort were retrieved more rapidly from long-term memory by members of that cohort. Older subjects named dated unique objects that were relatively more familiar to them, more rapidly than younger adult subjects, while the reverse was true for contemporary unique objects. In this study, older adults showed better memory performances than younger adults with stimulus materials that were more meaningful or familiar to them. Poon and Fozard (1978) concluded that the magnitude of age differences may be magnified by use of unfamiliar test stimuli in testing older adults, independent of other peculiarities of a task.

A study by Barrett and Wright (1981) investigated the effects of word familiarity and amount of semantic processing on recall differences between younger and older adults following an incidental semantic processing task. Specifically, younger and older adult subjects were compared on level of recall after being asked to rate words on either one or two semantic dimensions. The semantic processing tasks involved rating some words on the dimension of size, others on pleasantness, and others on both pleasantness and size. The rated words were either

"old" (i.e., poultice)_{Ta} or "young" (i.e., disco).

The authors proposed that one way to facilitate or inhibit semantic processing would be to manipulate word familiarity. They assumed that the amount of experience with a word (i.e., its familiarity) would be an important determiner of how elaborately that word could be processed. They hypothesized that if word familiarity determines degree of semantic processing, then older adults would process "old" words such as poultice and fedora more elaborately than younger adults. They predicted that this in turn would lead to higher recall for such words by older, compared to younger adults.

It was found that word familiarity and number of processing tasks both had a strong effect on recall. Older adults benefitted as much from additional semantic processing as younger adults. Additionally, older adults showed higher recall than younger adults, following processing of more familiar words. Barrett and Wright's (1981) study demonstrated that under conditions of appropriate stimulus control, older adults can achieve higher memory performance than younger adults.

Generally, with regard to age-related memory differences, it can be noted that the term "meaningfulness" has been used to refer independently, to the properties of a stimulus, as well as a way of processing information. In the next section, it is suggested that there is an

advantage to considering both aspects of the encoding process. First, the general notions of how structure, process and meaningfulness are conceptualized, and how they are related, within the information processing framework, will be discussed. Then, these notions will be applied to two studies designed to investigate the effects of stimulus meaningfulness and processing tasks on the memory performance of older and younger adult subjects.

Structure, Process and Meaningfulness

With the advent of the levels of processing formulation, memory performance has been analyzed in terms of what was done to the stimulus rather than in terms of the properties of that stimulus. Prior to this, emphasis on meaning meant a concern with characteristics or properties of verbal material. For example, meaningfulness of stimuli was scaled in terms of the number of associations elicited, or the proportion of subjects giving an association to stimulus items (e.g., Noble and McNeely, 1957). Based on these definitions, it was found that increasing meaningfulness of stimuli generally enhanced recall.

The levels of processing formulation also considers meaning as important for retention. Within this framework, however, meaning is manipulated by varying the demands of

an orienting task, rather than by varying characteristics of the material. Performance on a subsequent unexpected test of retention is generally higher following a task requiring subjects to attend to the meaning of presented items rather than to their sound or physical appearance.

This contemporary emphasis on process is partially derived from the information processing framework. Basic to this formulation is the assumption that a specification of the attributes of physical stimuli will provide an incomplete basis for inferring the specific characteristics of the mental representation of the physical stimulus. This current focus solely on process, however, may also be too extreme. It would seem that a more complete description would require knowing which of the stimulus attributes were processed, as well as the nature of that processing. That is, the logic of the information processing approach specifies that both memory processes and stimulus structure would be involved in the formation of the resulting memory trace (Hunt, Elliott and Spence, 1979). The effects of stimulus structure thus far, have received little theoretical attention within this framework. With a few exceptions in which semantic features were manipulated (e.g., Hyde and Jenkins, 1973; Seamon and Murray, 1976; Jacoby, Bartz and Evans, 1978; Hunt, Elliott and Spence, 1979) most studies supporting the levels of processing approach have held structural properties of stimuli constant and varied the nature of the

orienting task.

In a study by Jacoby et al. (1978), the scaled meaningfulness of stimulus material was varied across two orienting tasks. Performance on nonsense syllables of high and low meaningful (M) value was compared following either semantic or nonsemantic orienting tasks. Subjects in one condition judged the pronounceability of items, while subjects in the other condition, judged the meaningfulness of items. Based on the depth of processing view, Jacoby et al. (1978) predicted an interaction between scaled meaningfulness of the material and orienting task conditions. They expected that the effect of meaningfulness would be larger when the orienting task required subjects to deal with the meaning of the presented items.

It was found that high-M items were recalled more than low-M items following semantic processing, but the "M" value had no effect following nonsemantic processing. Also, the semantic orienting task was superior to the nonsemantic task for recall of high-M items, but the two tasks did not differ for recall of low-M items.

Seamon and Murray's (1976) study of semantic structural variables (i.e., high and low meaningful stimuli) in interaction with nonsemantic orienting tasks also found no effects of meaningfulness following nonsemantic processing.

These studies suggest that there are some limits on situations in which effects of task demands are to be found. They demonstrate that the encoded meaning of an event depends on the meaning-producing activity of the learner (processing demands), as well as the potential meaningfulness of the material. Jacoby et al.'s (1978) study, for example, showed that encouraging subjects to attend to meaning, had essentially no effect when the material was so impoverished as to be unable to support a meaningful analysis. That is, the manipulation of orienting tasks had little effect with low meaningful stimuli. In such circumstances, a learner can be made to appear very inflexible in his processing. Conversely, increasing the meaningfulness of the material had a limited effect when subjects were not directed toward an analysis of meaning.

Structural effects have been mentioned in the previous discussion in the context of physical stimuli and the memory trace. Theoretically, an important functional locus of structure can be conceptualized at the level of the knowledge base. For example, a word has a particular representation in semantic memory. Within the levels of processing view (Craik and Lockhart, 1972), this is assumed to be in the form of a set of qualitatively different features, such as orthographic, phonemic and semantic. Subsequent encoding of a word would involve activation of some subset of those features. The particular subset of

activated features, would define the memory trace for the event. The resulting memory trace then, can be viewed as a product of the structure of semantic memory representations in interaction with processes directing attention to some aspect of the structure (Hunt, Elliott and Spence, 1979). Thus, varying some aspect of the physical stimulus would be effective because corresponding differences in semantic memory representations would be expected to lead to different memory traces. In their original formulation, Craik and Lockhart (1972), did point out that retention is a function of both depth of processing and the compatability of the stimulus with existing cognitive structures. Subsequent research however, has tended to focus primarily on differential effects of qualitatively different encoding processes.

Age, Meaningfulness and Levels of Processing

Most studies (Walsh, 1975; Eysenck, 1974; White, cited in Craik, 1977; Perlmuter, 1978; 1979; Zelinski, Walsh and Thompson, 1978; Mason, 1979) employing the levels of processing framework to investigate age-related memory differences have not systematically examined the effects of stimulus structure, along with the usual task manipulations. Stimulus materials in these studies consist of lists of common words on which subjects are asked to perform various semantic or structural orienting tasks, to

influence the level of encoding. These studies usually attribute the poorer performance of older subjects following semantic processing to an inability of older adults to process information to deep and semantic levels, or a "processing deficit" (Eysenck, 1974).

In studies investigating age-related memory differences, stimulus materials and procedures are likely to be more unfamiliar or novel for older adults than for younger adults. This unequal baseline may serve to bias performance results in favour of younger adults.

In the present study it was hypothesized that the meaningfulness of stimulus items may be an important factor in determining differences in the elaborateness of processing and subsequent retention of such information, by older and younger adults. Craik (1973) proposed that among the variables that may lead to deeper processing of a stimulus input and thus to better memory, are the item's meaningfulness or compatibility with its underlying analyzing cognitive structures. More meaningful items are likely to have greater amounts of semantic-associative, or more generally, knowledge structures supporting these items. According to Craik and Lockhart (1972), deep processing enables a subject to make substantial use of such learned rules and past experience, so that materials can be handled more effectively and more can be retained. That is, the processing of more "meaningful" stimulus items

to deep levels should be facilitated by the availability and the activation of these existing, supportive structures, resulting in good retention. Thus, it was proposed that one way to facilitate or inhibit elaborate semantic processing might be to vary the meaningfulness of stimulus items, which were a list of short phrases in this study. It was suggested that items more "meaningful" for a particular age group, would be those that described experiences about events and situations that were of concern and importance to that group. That is, items that were of personal relevance to older and younger adults.

Since elaborative processing has been described as specifying more and more attributes of a stimulus input (Craik and Tulving, 1975; Klein and Saltz, 1976; Anderson and Reder, 1979), it was expected that manipulating "meaningfulness" of stimulus phrases would lead to differential amounts of stimulus elaboration during encoding, depending on the degree of personal relevance of the situations or events described in the phrases. Craik and Lockhart (1972) claimed that "high meaningful stimuli would always be processed to a deeper level than low meaningful stimuli when a semantic orienting task is employed" (page, 676). A possible reason for this may be that high meaningful stimuli relative to low meaningful stimuli, may be amenable to more elaborate processing at a particular depth of analysis.

Anderson and Reder (1979) proposed that the type and extent of elaborations are the product of one's real world experience with objects and events in one's environment. They further point out that, "The instructions that can produce such elaboration and the materials that can be readily elaborated must be defined with respect to the processor" (page 390). That is, notions about effective elaboration should be viewed from the perspective of the learner who must frequently supply his own elaborations in order to comprehend and remember information more precisely. Thus, it is expected that the same stimulus could be processed differently by different persons, depending on the personal relevance of the stimulus to the processors (Higgins, Kuiper and Olson, 1981).

Consider a phrase such as, "Enjoying visits to see grandchildren". This is a phrase that is relatively high in personal relevance for older adults and relatively low on this dimension for younger adults. If phrase relevancy determines the degree of elaborative processing then older adults might process such high relevant phrasetypes more elaborately than younger adults following semantic processing. This was expected because of the facilitation of the hypothesized availability and activation of the underlying semantic associative features concerning such items at deep levels of processing. This in turn, was expected to lead to higher recall for such items by older adults, compared to younger adults. Similarly, it was

expected that items high in personal relevance for younger adults, such as "Preparing lesson plans to present to classes", would lead to higher recall by younger adults, compared to older adults.

The following section will discuss the three orienting tasks used in this study. The three tasks were a semantic, self-referent rating task, a semantic, pleasant-unpleasant rating condition and a structural, spelling detection task. The two semantic tasks were expected to induce deep level processing. The structural task was assumed to produce low level, shallow processing of stimulus items. Each of these three tasks will be briefly described next.

Self-Referent Task. Self-referent decisions about stimulus information by subjects in a levels of processing paradigm have been shown to induce deep, semantic processing. In this type of orienting task condition, subjects are usually instructed to decide whether or not the stimulus information is descriptive of them (Rogers, 1977). Memory performance on a subsequent test of retention is usually found to be higher following such self-referent type processing than following processing requiring subjects to attend to structural features of the stimulus, such as its physical appearance.

Several investigators (e.g., Rogers, 1977; Rogers, Kuiper and Kirker, 1977; Kuiper and Rogers, 1979; Rogers, Rogers and Kuiper, 1979; Kuiper and Derry, 1980; Kuiper,

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1982) in the area of social cognition have formulated a theory of the "self" based on information processing models of cognitive psychology. Much of the focus has been on the construct of "self" and how it is implicated in the organization and processing of stimulus information. Rogers, Kuiper and Kirker (1977) have proposed that the self is an extremely active and powerful agent in the organization of a person's world. The self is viewed as a prototype or schema (e.g., Bartlett, 1932), in that it is defined as an abstract representation of past experience with personal information.

The self is assumed to consist of both a structural and functional component. On a structural level, the self has been defined as a list of terms or features derived from a lifetime of experience with knowledge about the self (Rogers et al., 1977). This list of features is assumed to consist of general terms, very much like "traits", which represent the abstracted essentials of a person's view of self. The list is also assumed to be comprised of "specific" terms concerning the self. These refer to less salient and more situation specific behaviours. Altogether, these terms are assumed to be ordered in an hierarchical fashion, ranging from general to specific.

On a functional level, the self is viewed as part of the information processing system that helps an individual in processing information about the self. The theory

(Rogers et al., 1977) assumes that when a person encounters a situation involving personal information, this structure of "self", in the form of a schema or prototype, is activated and becomes part of the available information processing system. This is assumed to provide a degree of "meaning" or embellishment to incoming information because of the availability of immense amounts of previous experience embodied in the self (Kuiper and Rogers, 1979; Rogers et al., 1979). According to this view, then, the self is seen as a "hook" or interpretative frame for the encoding of personal information. A central feature of self-reference is that the self is viewed as a background setting against which incoming data are interpreted or coded. This process involves an interaction between previous experiences of the individual in the form of an abstract structure of self, and the new, incoming information.

This cognitive model of the "self" has received considerable empirical support in studies with younger adult subjects. Rogers (1977) investigated recognition memory for personality items. Subjects in one experimental condition were instructed to read the items, decide if they described them and to use this to help their memory. These subjects performed better in a subsequent recognition memory task, than subjects receiving either no, or deep, semantic processing instructions such as imaging. The data indicate that explicit instructions to use the self in a

memory task increases task performance. This supports the claim that self-referencing serves to enrich stimulus input.

Self-referent decisions or instructions have also been found to result in enhanced recall (Kuiper and Rogers, 1979; Rogers et al., 1977), in comparison to other rating tasks or instructions such as pleasantness rating and imagery tasks. Moreover, self-reference is considered to be a powerful encoding device. That is, it is viewed as a mechanism that is active during encoding, rather than retrieval. Kuiper and Rogers (1979) provided data to argue against the notion that self-reference is a mechanism that acts at the time of retrieval, by conducting a clustering analysis of the recall data. The authors argued that if the data were a retrieval phenomenon, or simply a listing of self-referent features, some degree of clustering in output protocols should have been observed. That is, it was expected that items that had been processed by a self-referent task would be reported in succession during recall. Since this was not found, the data were interpreted as reinforcing the proposition that the self is a powerful agent during the encoding of personal information.

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Pleasant-Unpleasant Rating Task. Rating items for degree of pleasantness has been shown to produce deep processing (Walsh and Jenkins, 1973). The logic of this task involves the notion that subjects will interpret a stimulus according to prior language habits. In order to accomplish this task, subjects first determine the meaning of a stimulus item and then rate it against the pleasant-unpleasant dimension. Memory performance on a subsequent test of retention following this type of rating task has been shown to be higher than on tasks involving processing of physical features of stimulus items.

Structural Spelling Detection Task. This task requires subjects to check stimulus items for the presence of spelling errors. This structural condition is assumed to induce shallow encoding (i.e., Craik and Lockhart, 1972). Attention to physical features or attributes of a stimulus, generated by this type of task is not generally conducive to supporting long-term retention.

Aim and Rationale of Proposed Studies

The aim of the present research was to examine the effects of orienting tasks and stimulus meaningfulness on free recall memory performance of younger and older adults within a levels of processing paradigm. The variable of central interest was stimulus meaningfulness.

In Study I, subjects rated a series of phrases for their personal relevance. The phrases described situations and events assumed to be variable with regard to the concerns and interests of younger and older adults. Based on various selection criteria, a stimulus list consisting of phrases differing in personal relevance to younger and older adults was obtained for use in Study II. In addition, another variable, orienting task conditions was included. Three tasks were used to induce different depths or levels of processing. These were, two semantic tasks (i.e., self-referent and pleasant-unpleasant rating task conditions), and one structural task (i.e., spelling detection condition).

Based on the levels of processing formulation, it was hypothesized that if younger and older adults were required to process semantically, a list of phrases differentially meaningful for the two age groups, then older adults, compared to younger adults, would recall more items relatively higher in meaningfulness for their age group. Similarly, it was expected that younger adults, compared to older adults, would recall more items relatively higher in meaningfulness for them. Following structural processing of stimulus phrases, it was expected that if the task did not involve abstraction of meaning from the phrases, then there would be no effect of meaningfulness on recall differences between older and younger adults. Thus, an interaction between age, meaningfulness of stimulus phrases

and orienting tasks is predicted.

Predictions derivable from the "processing deficit" hypothesis (Eysenck, 1974), however would not support this contention for differences in recall performance of older and younger adults. This hypothesis suggests that older adults would show poorer levels of incidental recall, compared to younger adults, with "deep" (i.e., semantic) encoding tasks. According to this position, following the self-referent and pleasantness rating tasks, which have been shown to induce deep levels of processing, older adults should show the poorest recall performance, compared to younger adults. No or minimal difference would be expected following the structural spelling detection task.

The present studies seek to demonstrate that the types of stimuli that older and younger adults are required to process to "deep" levels may be an important determiner of how well that processing is carried out, as reflected in their recall performance. It has been argued that the higher the initial "meaningfulness" of an item, the greater will be the information derived from it and hence, the richer will be the resulting memory trace and thus, the higher the probability of its retrievability. If greater activation or contact does occur for more meaningful items, then it is expected that when younger and older adults presumably perform the same semantic orienting task (i.e., deep level processing), on the same set of stimulus items,

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those items rated as being initially higher in meaningfulness (i.e., personally relevant) for a particular age group, will be remembered more frequently by them, compared to the age group for whom the items are considered to be relatively low in meaningfulness. The significance of this is that it will demonstrate that older adults may perhaps show higher memory performance than younger ones, following deep processing with stimulus materials that have been controlled for their meaningfulness (i.e., relevancy) for older and younger adults.

STUDY I

The purpose of the initial study in this set was to obtain stimulus items that would reflect events or situations of differential personal relevance to younger and older adults.

METHOD

Subjects

Thirty young adult subjects were tested in this study. Fifteen were female, and fifteen were male. These subjects ranged in age from 22 to 28 years with a mean age of 24.1 years; the mean education level was 17.0 years. The young adult subjects were student teacher volunteers at a teachers college in Southwestern Ontario. Thirty old adult subjects were also tested in this study. Fifteen were female and fifteen were male. These subjects ranged in age from 60 to 68 years with a mean age of 63.5 years; the mean education level was 16.86 years. All older adult volunteers were retired school teachers, living in an urban centre in Ontario.

Materials

Four sets of 20 phrases each were composed by the Experimenter. The content of the phrases was assumed to reflect differentially, the interests or concerns of younger and older adults. One set of phrases was considered to be more personally relevant for older adults, while relatively low in personal relevance for younger adults(HL). For example, "Making adjustments to cope with retirement". A second set of phrases was considered to be high in personal relevance for younger adults, while relatively low in personal relevance for older adults(LH). For example, "Opposing decisions to raise tuition fees." A third set of phrases was considered to reflect high personal relevance for both younger and older adults(HH). For example, "Casting a vote to have a voice in government." A fourth set of phrases was constructed that would be low in personal relevance for both younger and older adults(LL). For example, "Climbing mountains to exercise body muscles". See Appendix A for each set of 20 phrases.

It can be noted that high meaningful items such as HL and LH phrasetypes were assumed to differ from high meaningful items such as HH phrasetypes in terms of the specificity of relevance of their contents to members of different cohorts in the two age groups. That is, HL and LH phrasetypes were assumed to be items of specific

interests and concerns to older and younger adults, respectively. These phrasetypes contained more generational bound issues. For older adults, HL phrasetypes included concerns about leisure, pension plans and retirement. For younger adults, LH phrasetypes reflected more school and work-related activities. In contrast, high meaningful items such as HH phrasetypes were assumed to reflect more general, less generational bound concerns and interests of both older and younger adults. The content of these phrases included, among others, concerns about nutrition, physical fitness and life satisfaction in general.

Each phrase was typed separately on a 5" x 8" index card. One set of stimulus materials consisted of a deck of 80 cards, containing one phrase each. Phrases were randomly ordered for presentation by means of a random number generator program, and numbered sequentially from "1" to "80".

Response booklets, consisting of one page of instructions (see Appendix B), and 8 response sheets, with ten rating scales typed on each page, were prepared. Each rating scale was numbered from "1" (Very Personally Irrelevant) to "7" (Very Personally Relevant).

Procedure

Each subject was given a deck of cards containing 80 phrases, numbered "1" to "80" and a response booklet, containing 80, seven-point rating scales. Both older and younger adult subjects were asked to read and follow the instructions on the sheet attached to each of the response booklets. In the instructions, subjects were told that the purpose of the exercise was to determine how personally relevant the events or situations described in the phrases were to them generally, in terms of their current lifestyle, interests and concerns.

Subjects were asked to rate each phrase on a scale ranging from "1" to "7". A rating of "1" would indicate that the event or situation described in the phrase was very personally irrelevant to the subject; a rating of "7" would indicate that the event or situation described in the phrase was very personally relevant to the subject. That is, it was very important or significant to the subject in terms of his current lifestyle, interests and concerns. Appropriate examples were included on the instruction sheet. As subjects read each phrase and rated it for personal relevance, they were to turn over each card, and proceed to the next phrase. Each subject was to repeat this procedure until all 80 phrases were rated.

The test materials were distributed to young adult subject volunteers in a classroom. Subjects were requested

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to complete the rating task and return the response sheets and test materials to the Experimenter. The task was identical for the older adult subjects. Requests for volunteers for the study were mailed to potential subjects. Those individuals who agreed to participate were sent the rating materials and instructions, and were requested to return the completed rating forms by mail.

RESULTS

The phrases, with mean ratings obtained from older and younger adult subjects are presented in Table 1.

Insert Table 1 about here.

Phrases selected as being high in meaningfulness or personal relevance for older adults(HL) received a mean rating of 6 or greater by older adults and a mean rating of 2 or less by younger adults. The same phrases were also considered as low in "meaningfulness" for younger adults. Phrases high in meaningfulness or personal relevance for younger adults(LH) were selected on a similar basis.

Phrases selected as being high in meaningfulness for both older and younger adults(HH), received a mean rating of 6 or higher by both older and younger adults. Phrases selected as being low in meaningfulness for both older and younger adults(LL) received a mean rating of 2 or less by both older and younger adult subjects.

Table 1

Mean Ratings of Phrases Obtained

From Older and Younger Adult Subjects in Study 1^a

Phrase	Mean Ratings	
	<u>O^b</u>	<u>Y^c</u>
1. Receiving social security benefits to supplement finances.	6.30	1.47
2. Securing student loans from government to pay living costs.	1.30	4.47
3. Attending high school dances to see former teachers.	1.30	1.30
4. Going to interviews to find a job after graduation.	1.37	6.83
5. Having access to a counselling centre to seek help.	1.67	3.83
6. Watching cartoons to pass Saturday mornings.	1.00	1.47
7. Preparing lesson plans to present to classes.	1.57	6.43
8. Climbing mountains to exercise body muscles.	1.37	2.53
9. Living in a democracy to have freedom of choice.	6.73	6.00
10. Using skate boards to travel about the city.	1.00	1.03
11. Fixing loose dentures to lessen the pain.	3.30	1.17
12. Being able to stay in good health.	6.97	6.57
13. Keeping photo albums to record happy times.	5.10	5.47
14. Buying crayons to draw colourful pictures.	1.00	2.50
15. Spending adequate time to do good assignments.	1.60	6.00
16. Attending concerts to view favourite musical groups.	4.30	3.90
17. Taking time to care for a garden.	6.13	2.00

<u>Phrase</u>	<u>Mean Ratings</u>	
	<u>O^b</u>	<u>y^c</u>
18. Depending on pension cheques to pay household bills.	6.03	1.20
19. Having time to pursue hobbies.	6.63	6.00
20. Going to drive-in movies to find a romantic setting.	1.07	1.57
21. Assembling toy blocks to model familiar structures.	1.10	1.30
22. Exercising the body to keep good health.	6.10	6.07
23. Playing weekly bingo to maintain social activity.	6.60	1.07
24. Owning a club membership to take short trips with others.	6.23	1.97
25. Avoiding icy sidewalks to prevent falls.	4.97	3.60
26. Casting a vote to have a voice in government.	6.83	5.37
27. Driving a car cautiously to avoid serious injury.	6.67	6.17
28. Enjoying visits to see grandchildren.	6.43	1.40
29. Joining teams to play shuffleboard.	6.37	1.30
30. Having courage to stand up for own beliefs.	6.57	6.23
31. Knowing laws help to protect citizens against criminal actions.	5.97	4.97
32. Going to pubs to have drinks with friends.	2.37	4.20
33. Donating large sums to support local charities.	2.57	2.57
34. Controlling weight to stay in good condition.	6.17	5.83
35. Being able to lead a happy life.	6.80	6.53
36. Striving to be honest in personal relationships.	6.83	6.60
37. Participating in quilting bees to make hand crafts.	2.23	1.77

<u>Phrase</u>	<u>Mean Ratings</u>	
	<u>O^b</u>	<u>Y^c</u>
38. Obtaining good grades to continue education.	1.13	6.07
39. Opposing decisions to raise tuition fees.	1.83	3.97
40. Taking many pictures to develop photographic skills.	3.33	4.33
41. Having to slow movements due to stiffening joints.	3.57	1.77
42. Joining the music club to become a band member.	1.00	1.37
43. Making adjustments to cope with retirement.	6.27	1.10
44. Disturbing the peace to get police attention.	1.00	1.03
45. Visiting the circus to see the clowns.	1.40	1.80
46. Flying kites to enjoy sunny afternoons.	1.40	3.33
47. Being with the family at Christmas to spend the holidays.	6.37	6.53
48. Planning meetings to play cards with a group.	6.20	1.93
49. Taking drama classes to provide a creative outlet.	1.13	2.00
50. Taking occasional naps to relieve tiredness.	4.37	3.83
51. Wearing warm clothes to prevent colds.	4.90	5.57
52. Reading newspapers to learn about current events.	6.53	6.00
53. Having campus libraries to provide reference sources.	1.73	6.07
54. Using public transportation to increase mobility.	3.90	3.97
55. Going horseback riding to master the skilled art.	1.07	1.93
56. Servicing own car to save some money.	3.67	4.37
57. Listening to the stereo to enjoy music.	4.73	5.53
58. Attending sports matches to support school teams.	1.37	3.30

Phrase	Mean Ratings	
	<u>O^b</u>	<u>y^c</u>
59. Trading comic books to get new reading material.	1.00	1.07
60. Watching television to follow the soap operas.	2.80	2.33
61. Budgeting money to live on a fixed income.	6.00	6.07
62. Having opportunity to make own decisions.	6.70	6.50
63. Learning proper way to write resumes to apply for jobs.	1.37	6.47
64. Practice teaching to fulfill course requirements.	1.20	6.60
65. Driving a sports car to project a youthful image.	1.20	1.57
66. Being able to offer advice to help son or daughter.	6.27	1.93
67. Having difficulty following conversations due to hearing problems.	3.50	1.37
68. Getting enough sleep to feel rested during the day.	6.07	6.17
69. Studying lecture notes to prepare for exams.	1.17	6.07
70. Phoning friends to talk about latest happenings.	4.23	4.77
71. Earning money in summer to return to classes.	1.07	4.37
72. Making careful decisions to ensure a successful career.	1.97	6.43
73. Developing athletic ability to join the army.	1.13	1.07
74. Eating healthy foods to maintain good nutrition.	6.40	6.20
75. Being able to ski in the winter season.	1.97	4.47
76. Being with friends to celebrate birthdays.	6.10	6.07
77. Going to the hospital to see ailing friends.	5.10	5.47
78. Writing letters to express a dissatisfaction with consumer products.	2.33	2.87
79. Handing in term papers on time to avoid losing marks.	1.03	6.27

<u>Phrase</u>	<u>Mean Ratings</u>	
	<u>o^b</u>	<u>y^c</u>
80. Attending church to take part in the services.	4.80	4.17

^aBased on n = 30 subjects in each age group.

^bo - Older adults.

^cy - Younger adults.

Applying the criteria just outlined, 10 phrases were found to be high in personal relevance for older adults(HL phrasetypes), and 10 phrases high in personal relevance for younger adults(LH phrasetypes). Fifteen phrases were found to be high in personal relevance for both older and younger adults(HH phrasetypes). Thirteen phrases were found to be low on this dimension for both older and younger adults(LL). See Appendix A for each set of phrases obtained from these relevancy ratings.

STUDY II

The aim of this study was to examine the effects of stimulus meaningfulness and orienting tasks on the memory performance of older and younger adults in a levels of processing paradigm.

METHOD

Subjects

Subjects tested in this study were selected from the same population as subjects in Study I. Young adult student teacher volunteers were selected from a college in Southwestern Ontario. Older adult subjects were retired teachers living in two urban centres in Ontario. These adults consented to participate following a request by mail for volunteers. A total of ninety-six subjects participated in this study.

Forty-eight younger adults were tested. Twenty-four were female and twenty-four were male. These subjects ranged in age from 22 to 29, with a mean age of 24.4 years. The mean education level for this group was 18.2 years. The mean vocabulary score, as measured by the Quick Word

Test, was 83.1% (see appendix C for a description and rationale for use of this test). Forty-eight older adults were also tested. Twenty-four were female and twenty-four were male. These subjects ranged in age from 60 to 69, with a mean age of 63.5 years. The mean education level for this group was 17.8 years. The mean vocabulary score was 87.0%. The scores for the older subjects were not adjusted for age because age norms are not available for this vocabulary test.

At the time of testing, subjects were asked to rate their current health status on a scale ranging from "1"(very poor) to "5"(excellent). In the younger adult group, 52.09% of the subjects rated their health as "good"; 47.91% of this group rated their health as "excellent". In the older adult group, 10.42% of the subjects reported their health as "good", 33.33% as "excellent" and 56.25% as "fair".

Materials

Stimulus materials were chosen from the four sets of phrases obtained by relevancy ratings from Study I. Eight phrases were chosen from each set, to comprise a list of 32 target items. Eight additional similar phrases (2 from each set); four at the beginning, and four at the end of the list, were included as buffer phrases to control for

primacy and recency effects. These latter eight phrases were not included in the data analysis. Thus, the stimuli comprised a list of 40 phrases (see Appendix D).

Each phrase was typed on a 5" x 8" index card. The stimulus materials comprised a deck of forty index cards, each containing one typed phrase. One presentation order was employed in the study which was determined by a random number generator.

Different answer booklets were prepared for each orienting task condition. Instructions specific to each orienting task were attached to subjects' answer sheets. Descriptions of, and instructions pertinent to each orienting task can be summarized as follows:

In the semantic, self-referent type task, subjects were instructed to read each phrase and decide whether the event or situation described by the phrase was personally relevant to them. Based on their decisions, subjects were asked to rate each phrase on a scale of "1" to "7" on their answer sheets. A rating of "1" would indicate that the event or situation described in the phrase was not very personally relevant to the subject; a rating of "7" would indicate that the event described in the phrase was very relevant to the subject (see Appendix E).

In the semantic, pleasantness rating task, subjects were instructed to read each phrase and to decide whether

the phrase described something that would, in their opinion, be pleasant or unpleasant. Based on their decisions, subjects were asked to rate each phrase for pleasantness, on a scale of "1" to "7", on their answer sheets. A rating of "1" would indicate that the event or situation in the phrase was not very pleasant, while a rating of "7" indicated that the event or situation was very pleasant to them (see Appendix F).

Subjects in the spelling detection condition were instructed to read each phrase to check if all words in each phrase were spelled correctly. They were asked to indicate the number of spelling errors in each phrase, if any, and to write down the word or words which they detected as misspelled (see Appendix G).

One-half of the stimulus phrases contained one spelling error; one-half had no spelling errors. Four phrases from each of the four phrasetypes (i.e., HL, LH, HH, and LL), contained one error and four from each set contained no spelling error. The four phrases from each set which contained one spelling error were chosen by means of a random number generator program. To misspell a word in a phrase, one letter in the word was doubled (for example, club-clubb, ability-abilitty, clowns-clownns). Words containing a spelling error were distributed approximately equally throughout the beginning, middle and end of the phrases. The stimulus phrases for the spelling

detection task were presented in the same order as the stimulus list for the two semantic orienting task conditions. See Appendix H for the stimulus list in the spelling detection task condition.

Response booklets for the free recall task were prepared for each subject. Each booklet contained an instruction sheet describing the task and blank pages for the written, free recall of stimulus phrases. The instructions required subjects to try to recall, in any order, all stimulus phrases which had been presented to them in the initial task. Subjects were encouraged to guess and to try to give the exact wording of phrases when possible (see Appendix I for instructions presented to subjects).

Procedure

Within each age group, 16 subjects were randomly assigned to one of three task conditions (i.e., to either one of two semantic orienting instructions group, or to the spelling detection instructions group). Within each of these conditions, half of the subjects were male and half female. All subjects were tested individually.

At the beginning of each experimental session each subject was first given a vocabulary test, the Quick Word Test (Borgatta and Corsini, 1964). Following this, each

subject was given a deck of 40 index cards containing the typed, stimulus phrases and an answer booklet. Subjects were instructed to read the task description in the answer booklet where relevant examples of the task requirements were provided. Subjects were asked to complete the required tasks, making appropriate responses in their answer booklets. The time taken by subjects to process each phrase was not noted. However, the total time taken for subjects to process all phrases in each incidental task was recorded.

Following completion of the initial orienting task, subjects in each condition were given response booklets for the free recall of stimulus phrases presented in the orienting task. No time limit was imposed for completion of this task.

At the end of each experimental session, each subject was asked not to discuss the study with other participants in the experiment. This was stressed because of the incidental nature of the learning paradigm.

Older and younger adult subjects were tested in exactly the same manner but at different locations. All younger adults were tested at the College. The majority of older adults were tested at their residences. Others were tested at a university campus.

PRELIMINARY DATA ANALYSES

The results of this investigation are presented in two main sections. The first section consists of an analysis of preliminary data. This part includes a check for consistency in stimulus phrase ratings in Studies I and II, percentage of spelling errors in the spelling detection condition, a description of how the stimulus phrases were scored for recall, and reliability measures to assess agreement for the scoring of stimulus phrases by two independent raters. Analyses for comparisons of subject groups on education, vocabulary and health measures are also included in this section. The second section includes main analyses of free recall scores of stimulus phrases and analyses of time measures for completion of the orienting tasks.

Self-Referent Rating Task: Consistency in Stimulus Phrase Ratings in Studies I and II

The mean relevancy ratings of the stimulus phrases for Study I and II obtained from younger and older adult subjects in the self-referent task condition are presented in Appendix J. To check the consistency of self-referent ratings between Studies I and II, a series of t-tests were calculated to test for differences in mean relevancy ratings obtained for each phrase in the two studies. Six

phrases were rated significantly differently in Study II, compared to Study I by younger adults. Five phrases were rated significantly differently in Study II, relative to Study I by older adults. However, for all these phrases, the mean differences were quite small. More importantly, with the exception of one phrase rated by older adults, the differences in mean ratings obtained from the two studies were not sufficiently large to change the classification of phrases as members of one of the four phrasetype categories (i.e., HL, LH, HH or LL). The results of these analyses suggested in general, that these stimulus phrases received similar mean ratings from younger and older adults in both studies.

Spelling Detection Task

Subjects made relatively few errors in performing the spelling detection task. Younger adult subjects in the spelling detection group had an error rate of 3.13%. Older adult subjects in this task condition had an error rate of 2.34%.

The errors made by subjects were essentially of two types. One, was that subjects did not detect that a misspelled word had been spelled incorrectly, the other, was that a correctly spelled word was occasionally mistaken for an incorrectly spelled word. The relatively low error

rates for both older and younger adults suggested that subjects were attending to the task, and performing it accurately as requested.

Scoring of Stimulus Phrases

Phrases recalled by subjects were scored by the experimenter and again, independently, by another rater. A phrase was viewed as consisting of an "activity" and a "purpose" portion. For example, for the phrase, "going to a community centre to play shuffleboard.", "going to a community centre", could be considered to be the activity portion and to "to play shuffleboard", the purpose. A phrase was considered to be correctly recalled and given a score of "1" if both parts of the phrase had been recalled. Verbatim recall for a phrase was not required. If the main ideas in both parts of a phrase were present, it was considered to be correctly recalled.

Four free recall scores were obtained for each subject. These were the number of phrases recalled from each of the four phrasetype categories (i.e., free recall of HL, LH, HH and LL phrases). It was possible for a subject to recall a total of 8 phrases from each of the 4 "meaningfulness" categories.

Reliability of Scoring for Stimulus Phrases

The mean recall scores assessed by the experimenter and by an independent rater for each phrasetype represented by Task and Age Level are presented in Table 2.

Insert Table 2 about here.

Analyses of variance to compare differences in mean free recall scores obtained by the experimenter and by the rater for each of the 4 phrasetypes (HL, LH, HH, LL), for each of the 6 groups of subjects resulted in no significant effects.

Also, correlation analyses between recall scores obtained by the experimenter and by the rater, for each of the 4 phrasetypes, for each of the six experimental groups, all showed statistically significant correlational relationships. The mean correlation coefficient value was $r = +.93$.

Table 2

Mean Recall Scores of Stimulus Phrases Scored by the Experimenter^c and an Independent Rater^a by Age Level^a, Task Condition^b and Phrasetype

Age Level	Task Condition											
	Self-Referent Rating			Pleasantness Rating			Spelling Detection					
							Phrasetype					
	HH	HL	LH	LL	HH	HL	LH	LL	HH	HL	LH	LL
Younger Adults												
Expt. ^c	4.31 (1.5)	0.69 (.8)	6.00 (1.2)	0.69 (.6)	3.94 (1.9)	1.19 (1.1)	6.25 (1.6)	1.44 (1.2)	1.06 (.8)	0.81 (1.1)	2.63 (1.0)	0.88 (.6)
Rt. ^d	4.19 (1.6)	0.50 (.7)	5.94 (.8)	0.69 (1.1)	3.94 (1.9)	1.06 (1.0)	6.13 (1.8)	1.25 (1.1)	1.06 (.8)	0.75 (1.0)	2.56 (1.0)	0.75 (.6)
Older Adults												
Expt.	3.56 (1.5)	6.31 (1.3)	0.31 (.5)	0.94 (.9)	4.06 (2.0)	6.06 (2.1)	0.81 (.8)	0.81 (.8)	1.00 (.9)	1.88 (1.0)	0.75 (.5)	0.69 (.6)
Rt.	3.50 (1.5)	6.25 (1.5)	0.19 (.4)	0.88 (1.0)	4.00 (2.0)	6.00 (2.1)	0.50 (.6)	0.81 (.8)	0.94 (.9)	1.88 (1.1)	0.63 (.5)	0.63 (.7)

^a n = 16 subjects in each cell.

^b Standard deviations are presented in brackets in each cell.

^c Experimenter

The correlation coefficients, represented by Age Level and Task Condition are presented in Table 3.

Insert Table 3 about here.

In addition, percentage agreement between the two raters for scoring of the stimulus phrases ranged from 96.1% to 100% across the various phrasetypes, task conditions and age levels, with a mean percentage agreement of 98.80% (s.d. = .92).

Together, these sets of analyses provided evidence that there was consistency in the scoring of phrases that were recalled by subjects. The recall scores used in the main analyses of the data were those scored by the experimenter.

Education and Intelligence Measures of Younger and Older Adults

Subjects in this study were randomly assigned to each of the orienting task conditions. They were not matched experimentally on the factors of intelligence (as indexed

Table 3
Intercorrelations Between Recall Scores Scored by the Experimenter
and an Independent Rater^a by Age Level, Task Condition and Phrasetype^{a*}

Age Level	Task Condition ^b													
	Self-Referent Rating				Pleasantness Rating								Spelling Detection	
	Phrasetype ^c													
	HH	HL	LH	LL	HH	HL	LH	LL	HH	HL	LH	LL		
Younger Adults	.98	.88	.98	1.00	.98	.95	.96	.95	1.00	.97	.97	.84		
Older Adults	.99	.94	.71	.97	.99	.99	.70	1.00	.96	.94	.75	.94		

^a n = 16 subjects in each cell.

^b Mean correlation value = 0.93.

^c HH - high meaningful phrases for older and younger adults.

HL - high meaningful phrases for older adults, low meaningful for younger adults.

LH - high meaningful phrases for younger adults, low meaningful for older adults.

LL - low meaningful phrases for younger and older adults.

* p < .001.

by a vocabulary score), or on years of education. The six groups of subjects in this study were compared for differences in education and intelligence.

The mean education level and mean vocabulary scores for each of the six groups, represented by age level and task condition, are presented in Table 4.

Insert Table 4 about here.

A 2 x 3 (i.e., 2-Age by 3-Orienting Task condition) analysis of variance for differences in education among the six groups of subjects yielded no significant main or interaction effects (See Appendix K). Thus, the subjects in this study did not differ in education.

A 2 x 3 (i.e., 2-Age by 3-Task condition) analysis of variance for differences in mean vocabulary scores among the six groups of subjects yielded a significant main effect of age, $F(1,90) = 11.26, p < .01$. No other main or interaction effects were significant (see appendix K). Older adults (mean=87.0) had significantly higher vocabulary scores than younger adults (mean=83.09).

Table 4
 Mean Education Level (number of years completed in school)
 and Mean Vocabulary Scores (%) on the Quick Word Test
 by Age Level and Task Condition^a

Age Level	Task Condition ^b		
	Self-Referent Rating	Pleasantness Rating	Spelling Detection
Younger Adults			
Education Level	18.3 (1.44)	18.6 (1.50)	18.0 (0.97)
Vocabulary Score	82.9 (4.40)	83.4 (5.99)	82.9 (5.16)
Older Adults			
Education Level	17.8 (1.34)	18.3 (1.18)	17.4 (1.26)
Vocabulary Score	86.4 (5.84)	87.0 (6.53)	87.6 (6.13)

^a Standard deviations are presented in brackets in each cell.

^b $n = 16$ subjects in each cell.

Additional analyses were conducted to determine how vocabulary scores were correlated with the performance measure of free recall. The four types of recall scores (HL, LH, HH, LL), for younger and older adults in each of the three task conditions were correlated with their vocabulary scores. The correlation coefficients represented by Age level and Task condition are presented in Table 5.

Insert Table 5 about here.

Of the 24 correlations, only two were statistically significant. Both of these occurred for older adults in the spelling detection condition. In this task condition, the recall of HH phrasetypes was found to be significantly correlated with the vocabulary score, $r = -.60$, $p < .01$; also, for this group, the recall of HL phrasetypes was found to be significantly correlated with the vocabulary score, $r = -.63$, $p < .01$.

In general, since vocabulary scores were either mostly unrelated or negatively related to recall performance a covariate analysis to control for differences in vocabulary

Table 5

Correlation Coefficients Between Vocabulary Scores and Recall Scores
by Age Level, Task Condition and Phrasetype^a

Age Level	Task Condition											
	Self-Referent Rating			Pleasantness Rating						Spelling Detection		
	Phrasetype ^b											
	HH	HL	LH	LL	HH	HL	LH	LL	HH	HL	LH	LL
Younger Adults	.13	.16	.21	.29	-.13	.12	.10	-.01	.07	.13	.07	.21
Older Adults	-.01	.31	-.24	.26	-.19	-.33	.34	.37	-.60*	-.63*	.30	-.20

^a n = 16 subjects in each cell.

^b HH - high meaningful phrases for older and younger adults.
HL - high meaningful phrases for older adults, low meaningful for younger adults.
LH - high meaningful phrases for younger adults, low meaningful for older adults.
LL - low meaningful phrases for older and younger adults.

*p < .01.

critical value r = .497, p < .05.

explanations for these findings can be considered. These will be discussed in the next two sections.

Time Factor

A comparison of differences between younger and older adults for time to complete the three orienting tasks yielded a significant main effect of age and a significant main effect of task. These results suggested that first, overall, older adults spent more time processing the stimulus phrases than younger adults. Secondly, there were no differences in time for completion of the two semantic tasks, while the structural task took longer to complete than both of the semantic tasks (i.e., self-referent and pleasant-unpleasant ratings) which did not differ in processing time. Also, correlation analyses between recall and total time to complete the orienting tasks computed for each of the six groups, yielded one significant positive correlation. This was for older adults in the self-referent condition. It is possible that the longer processing time taken by older adults can account for the finding of a lack of age differences in recall scores.

However, a time factor is not a likely explanation. A covariate analysis of variance for differences among subject groups for total free recall of stimulus phrases, with time to complete the orienting tasks as a covariate

scores between older and younger adults was not conducted.

Health Factor

The mean health ratings for each of the six groups of subjects, represented by Age level and Task condition, are presented in Table 6.

Insert Table 6 about here.

A 2 x 3 (i.e., 2-Age by 3-Task condition) analysis of variance for differences in mean health ratings among the six groups of subjects yielded a significant main effect of age, $F(1,90) = 4.54$, $p < .05$. Younger adults (mean = 4.51) had significantly higher ratings than older adults (mean = 4.23). No other main or interaction effects were significant.

Further analyses were conducted to determine how health ratings were correlated with the performance measure of free recall. Total recall scores (i.e., collapsed across relevancy or meaningfulness levels) for younger and older adults in each of the three task conditions, were

Table 6
Mean Health Ratings^a by Age Level and Task Condition^b

Age Level	Task Condition ^c		
	Self-Referent Rating	Pleasantness Rating	Spelling Detection
Younger Adults	4.44 (.51)	4.56 (.51)	4.44 (.51)
Older Adults	4.38 (.50)	4.13 (.72)	4.19 (.66)

^aHealth status was rated by subjects on a scale of "1"(very poor) to "5"(excellent).

^b_n = 16 subjects in each cell.

^cStandard deviations are presented in brackets in each cell.

correlated with their health ratings. The analyses yielded one significant positive correlation. This was for older adults in the pleasantness rating condition, $r = +.60$, $p < .007$.

RESULTS

Main analyses were conducted on recall scores assessed by the experimenter. The mean number of phrases recalled by younger and older adults, as a function of relevance or meaningfulness (i.e., HH, HL, LH and LL phrasetypes), in each of the three orienting task conditions, is presented in Table 2. Also, Table 7 presents the mean recall of stimulus phrases by age level, collapsed across phrasetypes and task conditions, respectively.

Insert Table 7 About Here.

An inspection of the top panel of Table 7 suggests that recall was higher in the self-referent and pleasantness rating conditions than in the spelling detection condition. The bottom panel of Table 7 suggests that recall of LL phrasetypes was considerably lower than recall in the other three phrasetype categories.

An analysis of variance for differences in mean recall of phrases among the subjects, for a 2(Age Level) by

Table 7

Total Mean Recall of Stimulus Phrases by Age Level and Task Condition^a
(Collapsed Across Phrasetypes)

Age Level	Task Condition ^b			
	Self-Referent Rating	Pleasantness Rating	Spelling Detection	Mean
Younger Adults	2.92 (1.02)	3.20 (1.44)	1.34 (.85)	2.49
Older Adults	2.78 (1.04)	2.94 (1.41)	1.08 (.70)	2.27
Mean	2.85	3.07	1.21	2.38

Total Mean Recall of Stimulus Phrases by Age Level and Phrasetype
(Collapsed Across Task Conditions)

Age Level	Phrasetype				Mean
	<u>HH</u>	<u>HL</u>	<u>LH</u>	<u>LL</u>	
Younger Adults	3.10 (1.40)	0.90 (0.98)	4.96 (1.23)	1.00 (.81)	2.49
Older Adults	2.87 (1.47)	4.75 (1.42)	0.62 (.59)	0.81 (.79)	2.27
Mean	2.99	2.82	2.79	.91	2.38

^a_n = 16 subjects in each cell.

^bStandard deviations are presented in brackets in each cell.

3(Orienting Task Condition) by 2(Sex) by 4(Relevance of phrasetypes) mixed design, yielded the following results:

No significant main effect of age, a significant main effect of task, $F(2,84) = 99.07$, $p < .01$, a significant main effect of relevance(i.e., meaningfulness) $F(3,252) = 65.66$, $p < .01$, a significant age by relevance interaction effect, $F(3,252) = 189.14$, $p < .01$ a significant task by relevance interaction effect, $F(6,252) = 10.36$, $p < .01$, and a significant age by task by relevance interaction effect, $F(6,252) = 20.53$, $p < .01$. There were no significant main or interaction effects for sex and, therefore, this factor was not included in subsequent analyses. A summary of this analysis is presented in Appendix L.

Analyses of simple interaction and simple simple main effects were conducted to determine sources of the significant age by task by relevance interaction. See Appendix M for Tables presenting the simple effects of the age by task by relevance (i.e., meaningfulness) interaction.

Free Recall of Stimulus Phrases as a Function of Age and Relevance in each Task Condition

A comparison for differences between younger and older adults, for recall of the 4 phrasetypes differing in relevance, yielded a significant age by relevance simple interaction effect, in the self-referent, $F(3,270) = 121.40$, $p < .01$, pleasantness rating, $F(3,270) = 100.56$, $p < .01$, and spelling detection tasks $F(3,270) = 8.28$, $p < .01$.

Additional simple simple main effect analyses for differences in recall of stimulus phrases revealed a similar pattern of results for age group comparisons in each task condition. A comparison for differences in recall of HL phrasetypes between older and younger adults yielded significant simple simple main effects of age in the self referent, $F(1,360) = 182.91$, $p < .01$, pleasantness rating, $F(1,360) = 137.39$, $p < .01$ and spelling detection tasks, $F(1,360) = 6.53$, $p < .05$. In each of these conditions, older adults recalled significantly more HL phrasetypes than younger adults.

Similarly, a comparison for differences in recall of LH phrasetypes between older and younger adults yielded significant simple simple main effects of age in the self-referent, $F(1,360) = 187.00$, $p < .01$, pleasantness rating, $F(1,360) = 170.92$, $p < .01$ and spelling detection tasks, $F(1,360) = 20.32$, $p < .01$. Younger adults recalled

significantly more LH phrasetypes than older adults in each of the three task conditions.

The simple simple main effects of age for recall of HH and LL phrasetypes were not significant in the self-referent, $F(1,360) = 3.25, p > .05$, $F(1,360) < 1$, pleasantness rating, $F(1,360) < 1$, $F(1,360) = 2.26, p > .05$, and spelling detection tasks, $F(1,360) < 1$, $F(1,360) < 1$, respectively. In each of the three task conditions, there were no significant differences in recall of HH or LL phrasetypes between older and younger adults.

Free Recall of Stimulus Phrases Represented by Task and Relevance at Each Level of Age

Comparison of Recall of Stimulus Phrases by Older Adults Among the Three Task Conditions. A comparison for differences in recall for older adults, for the 4 phrasetypes differing in relevance, among the three task conditions, yielded a significant task by relevance simple interaction effect, $F(6,270) = 17.87, p < .01$.

A comparison for differences in recall of HH phrasetypes by older adults among the three task conditions, yielded a significant simple simple main effect of task, $F(2,360) = 31.21, p < .01$. Additional t tests revealed that older adults recalled significantly more HH phrases in the self-referent task (mean=3.56) than in the

spelling detection task (mean=1.00), $t = 6.16$, $p < .05$ (critical value, $t'_{.05} = 1.96$, for simple simple main effect of task comparisons; Cochran and Cox, cited in Kirk, 1968). Older adults recalled significantly more HH phrases in the pleasantness rating task (mean=4.06), than in the spelling detection task (mean=1.00), $t = 7.36$, $p < .05$. There were no differences in recall of HH phrases by older adults between the self-referent (mean=3.56), and pleasantness rating tasks (mean=4.06), $t = 1.20$, $p > .05$.

A comparison for differences in recall of HL phrasetypes by older adults among the three task conditions, yielded a significant simple simple main effect of task, $F(2,360) = 71.86$, $p < .01$. Additional t tests showed that older adults recalled significantly more HL phrases in the self-referent task (mean=6.31) than in the spelling detection task (mean=1.88), $t = 10.67$, $p < .05$. Older adults recalled significantly more HL phrases in the pleasantness rating task (mean=6.06) than in the spelling detection task (mean=1.88), $t = 10.07$, $p < .05$. There were no differences in recall of HL phrases by older adults between the self-referent (mean=6.31) and pleasantness rating tasks (mean=6.06), $t = .60$, $p > .05$.

There were no significant simple simple main effects of task for recall of LL phrasetypes, $F(2,360) < 1$, and for recall of LH phrasetypes, $F(2,360) < 1$, by older adults.

Comparison of Recall of Stimulus Phrases by Younger Adults Among the Three Task Conditions. A comparison for differences in recall by younger adults for the 4 phrasetypes differing in relevance, among the 3 task conditions, yielded a significant task by relevance simple interaction effect, $F(6,270) = 13.03, p < .01$.

A comparison for differences in recall of HH phrasetypes by younger adults among the three task conditions, yielded a significant simple main effect of task, $F(2,360) = 36.55, p < .01$. Additional t tests revealed that younger adults recalled significantly more HH phrases in the self-referent (mean=4.31) than in the spelling detection task (mean=1.06), $t = 7.81, p < .05$. Younger adults recalled significantly more HH phrases in the pleasantness rating (mean = 3.94) than in the spelling detection task (mean = 1.06), $t = 6.91, p < .05$. There were no differences in recall of HH phrases by younger adults between the self-referent (mean=4.31) and pleasantness rating tasks (mean=3.94), $t = .90, p > .05$.

A comparison for differences in recall of LH phrasetypes by younger adults among the three task conditions, yielded a significant simple main effect of task, $F(2,360) = 47.39, p < .01$. T tests revealed that younger adults recalled significantly more LH phrases in the self-referent (mean=6.00) than in the spelling detection task (mean=2.63), $t = 8.11, p < .05$. Younger

adults recalled significantly more LH phrases in the pleasantness rating (mean=6.25) than in the spelling detection task (mean=2.63), $t = 8.72$, $p < .05$. There were no differences in recall of LH phrases by younger adults between the self-referent (mean=6.00) and pleasantness rating tasks (mean=6.25), $t = -.60$, $p > .05$.

The simple main effects of task were not significant for recall of LL phrasetypes, $F(2,360) = 1.76$, $p > .05$, and for recall of HL phrasetypes, $F(2,360) < 1$, by younger adults.

Total Free Recall of Stimulus Phrases Collapsed Across Relevance Levels

A 2×3 (i.e., 2-Age by 3-Task condition) analysis of variance for differences in recall scores, collapsed across relevancy levels (i.e., phrasetypes) yielded a main effect of task, $F(2,90) = 103.05$, $p < .001$. No other effects were significant. T tests for comparisons of means for the main effect of task revealed that overall recall of stimulus phrases was higher in the self-referent, $t(90) = 11.59$, $p < .05$, and in the pleasantness rating tasks, $t(90) = 13.2$, $p < .05$, than in the spelling detection task. There were no differences in total recall of stimulus phrases between the self-referent and pleasantness rating tasks, $t(90) = -1.54$, $p > .05$.

Time for Completion of the Orienting Tasks

The mean time (in seconds) taken by each of the 6 groups of subjects to complete the three orienting tasks are presented in Table 8.

Insert Table 8 About Here.

A 2 x 3 (i.e., 2-Age by 3-Orienting Task) analysis of variance for differences in time to complete the tasks, yielded a main effect of age, $F(1,90) = 7.24$, $p < .01$, and a main effect of task, $F(2,90) = 23.63$, $p < .01$. No other effects were significant (see Appendix N). Older adults (mean=398.95 seconds) required significantly more time to complete the orienting tasks than younger adults (mean=360.94 seconds).

T tests revealed that subjects took longer to complete the spelling detection task (mean=446.72 seconds) than the self-referent rating task (mean=332.66 seconds), $t(90) = 6.59$, $p < .01$. The spelling detection task (mean=446.72 seconds) took longer for completion than the pleasantness rating task (mean=360.47 seconds), $t(90) = 4.98$, $p < .01$. There were no differences in time to complete the

Table 8
 Mean Time (in seconds) for Completion of Orienting
 Tasks by Age Level and Task Condition^a

Age Level	Task Condition ^b		
	Self-Referent Rating	Pleasantness Rating	Spelling Detection
Younger Adults	321.6 (65.34)	349.4 (62.98)	411.9 (70.61)
Older Adults	343.8 (67.79)	371.6 (50.02)	481.6 (91.79)

^a Standard deviations are presented in brackets in each cell.

^b n = 16 subjects in each cell.

self-referent (mean=332.66 seconds) and the pleasantness rating tasks (mean=360.47 seconds), $t(90) = -1.61$, $p > .05$.

Covariate Analysis for Total Number of Phrases Recalled
With Time to Complete Orienting Tasks as Covariate

A 2×3 (i.e., 2-age by 3-Orienting task) analysis of covariance with time for completion of the orienting tasks as a covariate, produced a main effect of task, $F(2,89) = 71.68$, $p < .001$. No other main or interaction effects were significant.

Correlations Between Time to Complete Orienting Tasks and
the Number of Phrases Recalled

Correlation coefficients between time to complete the orienting tasks and total number of phrases recalled represented by Age level and Task condition are presented in Table 9.

Insert Table 9 About Here.

Table 9
Correlation Coefficients Between Total Time to Complete
Orienting Tasks and Number of Phrases Recalled
by Age Level and Task Condition^a

Age Level	Task Condition		
	Self-Referent Rating	Pleasantness Rating	Spelling Detection
Younger Adults	-.21	-.03	-.13
Older Adults	+.48*	-.01	-.14

^an = 16 subjects in each cell.

*p < .03.

Correlation analyses between the number of phrases recalled and time for completion of the orienting tasks, for each of the six experimental groups, resulted in one statistically significant correlation. There was a significant positive correlation, $r = +.48$, $p < .03$, between the total time taken by older adults to complete the semantic, self-referent rating task, and the number of phrases recalled by them in that task condition.

Footnotes

1. Both older and younger adults recalled more phrases that were "specifically" high in personal relevance to their age group (i.e., HL and LH phrasetypes), compared to items that were "generally" high on this dimension (i.e., HH phrasetypes). This difference in recall between high relevance items may reflect differences in encoding of such items. Processing items of high "specific" relevance, compared to items of more "general" relevance, may lead to the formation of a more congruent, and thus a more integrated memory trace with existing, "stored" knowledge about the "self". Such differences in encoding of the two types of highly relevant phrases, may have contributed to "easier" access to items of specific, personal interest at retrieval, compared to items whose contents reflected highly relevant, but more "general" concerns.
2. A time limit was not imposed for recall of the stimulus items at retrieval. Also, the time that subjects did take to complete recall was not recorded. However, it can be noted that in this study, older adults in general seemed to spend considerably more time on the recall task than younger adults. It is possible that older and younger adults may have employed differential external or internal criteria for deciding when to terminate recall of the stimulus phrases. They may have decided to stop after a certain amount of time had elapsed. Or, a decision may have been made on the basis of "internal" factors. For example, some subjects may not have stopped until all possible retrieval strategies had been exhausted. Others may have stopped the first time an additional phrase could not be recalled. To the extent that an unrestricted time limit results in the use of such differential criteria by younger and older adults, such variability could have implications for the magnitude of any observed age-related differences in recall performance.

3. A comment can be made about the education level of the sample of younger and older adults tested in this study. The education level of the younger and, especially, the older adults is likely higher than would be expected from members of the more general population. The higher education level of the sample of subjects in the present studies may be due to the fact that subjects were selected from a subpopulation, namely, members of the teaching profession. Some studies (e.g., Gardner and Mongue, 1977; Taub, 1979) suggest that adult age differences in cognitive functioning tend to be less pronounced for adults of high education status, compared to adults with a lower level of education. In the present study, the samples of subjects were not representative of older and younger adults in the general population. Also, the education level of the samples was relatively high. Due to these two factors, there may be a limit to the generalizability of the results and thus, the conclusions that have been made with regard to the obtained age-related differences in memory performance.

DISCUSSION

Age Differences in Recall by Phrasetype

The main purpose of this study was to address the general question of "processing deficiency", to determine if under appropriate conditions, older adults could be shown to process stimuli to deep semantic levels. Studies of recall, comparing performance of older and younger adults following different levels of processing have typically demonstrated an age-related decrement. The greatest age-difference in recall scores have been found following semantic processing, with no or minimal differences following structural processing. The poorer processing of older adults following semantic processing has been called a processing deficiency (Eysenck, 1974).

In the present study, it was proposed that the meaningfulness of stimulus items may be an important factor in determining how elaborately such information is processed by older and younger adults. Meaningfulness was defined in terms of the personal relevance to older and younger adults, of events and situations described in a series of short phrases. It was hypothesized that older and younger adults would recall more phrases that were specifically meaningful to their age group following deep level processing tasks.

This seemed to be the case for both semantic incidental tasks employed in this study. One involved rating phrases for personal relevance. The other task required subjects to make a decision concerning the pleasantness or unpleasantness of the activities or events expressed in the phrases. As predicted, following both processing tasks, older adults, compared to younger adults, recalled more phrases defined as relatively high in meaningfulness for their age group, while relatively low in meaningfulness for the younger age group (i.e., HL phrases). Conversely, younger adults, compared to older adults, recalled more phrases that were high in meaningfulness for them, but which were relatively low in meaningfulness for older adults (i.e., LH phrases).

Thus, the age-related deficit typically reported for older adults was demonstrated for recall of LH phrasetypes. However, for HL phrases, (i.e., items relatively more meaningful for older adults), the reverse was true. That is, older adults recalled more of these phrases than younger adults. In this instance, it was the younger adults who demonstrated a deficit for recall of HL phrasetypes, compared to the older adults.

Craik and Tulving (1975) have suggested that retention of a stimulus is a function of both its depth of processing and spread of encoding. It was assumed that varying the relevance or meaningfulness of the stimulus phrases in this

study would affect the spread of encoding. It was expected that the processing of items more meaningful for a particular age group would allow greater spread of encoding. That is, greater contact would be made with the underlying cognitive structures, containing the semantic-associative features for these items. The memory traces following processing of such high meaningful items would be assumed to reflect this greater elaboration and richness derived from activation of these structures. High meaningful stimuli (i.e., HL phrases for older adults and LH phrases for younger adults) were phrases reflecting activities or events high in personal relevance for younger and older adults. Semantic processing of such phrases would presumably tap a great deal of underlying knowledge concerning experiences of the "self" in specific relation to the highly relevant activities and events. This may have facilitated a more elaborate coding of such items (Kuiper and Rogers, 1979). Deep processing of highly meaningful items would be associated with higher performance levels because at deeper levels, encoding operations are more richly interconnected and activated, thereby facilitating elaboration of such items during input processing (Anderson and Reder, 1979).

Also, perhaps because of the way in which highly meaningful stimuli (i.e., HL and LH phrasetypes) were defined in this study, it is possible that the underlying memory codes for such items may have achieved a certain

degree of distinctiveness. This may have facilitated accessibility to the memory traces during retrieval (Jacoby and Craik, 1979).

Items low in meaningfulness for a particular age group (i.e., LH phrases for older adults and HL phrases for younger adults) even though they may have been processed to the same depth as more high meaningful phrases (through an orienting task manipulation), would not likely have been subjected to the same spread of encoding. The reason for this is the presumed lower availability and therefore, activation of underlying cognitive structures concerning such items. The minimal elaboration that is assumed to occur during processing of such items perhaps resulted in the formation of less enriched, less elaborate (in terms of their semantic-associative content), memory codes for these items. This would suggest less accessibility, and thus, a lower probability of retrievability for items relatively low in meaningfulness for a particular age group.

There were no differences in recall between younger and older adults for HH and LL phrasetypes. Since HH and LL phrasetypes were relatively high and low in meaningfulness, respectively, for both age groups, perhaps the "relative" extent of elaborative processing of these items at "deep" levels was about the same for older and younger adults during encoding.

For the spelling detection condition, it was expected that if the the task could be accomplished without abstracting the meaning of the phrases, then there would be no effect of meaning on recall following processing of all four phrasetypes by older and younger adults. The predictions were partially supported by the outcome. There were no differences in recall of HH and LL phrasetypes between older and younger adults in this processing condition. It was found, however, that older adults recalled more HL phrasetypes than younger adults, whereas younger adults recalled more LH phrasetypes than older adults. That is, in this task condition as in the two semantic conditions, phrases relatively more meaningful for one age group and relatively low in meaningfulness for the other age group resulted in greater recall.

A possible reason for this outcome may be the nature of the processes involved in performance of the spelling detection task. It was assumed that this type of task would induce shallow processing of the phrases. However, the fact that effects of meaningfulness were also found following low level processing would suggest that additional information besides the operations required to complete the task, was also encoded. Jacoby and Craik (1979) have pointed out that the nonzero level of retention in performance found in most levels of processing studies following nonsemantic, shallow level processing provides evidence that information beyond the minimal amount

necessary to accomplish the orienting task must have been encoded. Nelson, Walling and McEvoy (1979) also observed and commented on this finding in their study. They claim that some semantic analyses may be carried out when attention is focused upon structural features although this type of analysis is not considered to be elaborate. They attribute this activation of meaning to "habitual" semantic processing. This processing may be especially difficult to inhibit when the target item has at least one readily accessible semantic representation.

In the current study as well, detection of spelling errors in words, especially words embedded in a phrase context, may have involved however minimally, some contact or activation with the meaning of the phrase. If this were the case, then it would be expected that high meaningful items, relative to low meaningful items, may have made greater contact with the contents of semantic memory, resulting in their higher recall. The results seem to support this contention.

Levels of Processing Distinction

It was expected that semantic processing conditions such as the self-referent and pleasantness rating tasks would induce "deep" level processing and thus lead to higher recall than the structural, spelling detection task

which was expected to induce "shallow", low level processing of stimulus phrases. It was expected that semantic tasks would involve an analysis of meaning of the stimulus phrases, whereas the spelling detection task would involve analysis of the physical features of the phrases. This levels of processing distinction was obtained for recall of high meaningful phrases (i.e., HH and HL) by older adults. That is, older adults recalled more of these phrases in the self-referent and pleasantness rating conditions than in the spelling detection condition. There were no differences in the recall of these phrasetypes by older adults between the semantic rating conditions. This pattern of results was the same for the recall of high meaningful phrases (i.e., HH and LH) by younger adults among the three orienting task conditions.

There were no differences in the recall of low meaningful phrases (i.e., LL and LH) by older adults, and for the recall of phrases low in meaningfulness for younger adults (i.e., LL and HL) across all three task conditions. For both older and younger adults, low meaningful phrases did not benefit from deep level processing.

Thus, for both older and younger adults, high meaningful phrases processed to deep levels resulted in higher recall than high meaningful items processed at a shallow level. Also, for both these age groups, there were no differences in recall of low meaningful phrases at high

and low levels of processing. The significance of this interaction is noteworthy because the stimuli were natural language material. Even with low meaningful phrases, it was expected that subjects would be able to derive meaning from the phrases, that is, formulate a reasonable interpretation of the content. Thus, recall of low meaningful phrases was expected to be higher following deep, compared to shallow level processing. However, there was an absence of a depth of processing effect for the recall of low meaningful phrases. Perhaps because the relevancy value of these phrasetypes was relatively low, older and younger adults were not able to benefit from stimulus elaboration assumed to be facilitated at deeper levels of processing.

Age Effect on Recall Performance

In this study, the free recall analysis yielded no main effect of age. The absence of this effect challenges the notion that older adults show lower performance on recall following a semantic processing task because they cannot process as deeply or elaborately as younger adults. The results from the current study do not support Eysenck's (1974) processing deficiency claim. The results do suggest that given appropriate task conditions, older adults can, and do process stimulus material for later recall as efficiently as younger adults. However, alternative

explanations for these findings can be considered. These will be discussed in the next two sections.

Time Factor

A comparison of differences between younger and older adults for time to complete the three orienting tasks yielded a significant main effect of age and a significant main effect of task. These results suggested that first, overall, older adults spent more time processing the stimulus phrases than younger adults. Secondly, there were no differences in time for completion of the two semantic tasks, while the structural task took longer to complete than both of the semantic tasks (i.e., self-referent and pleasant-unpleasant ratings) which did not differ in processing time. Also, correlation analyses between recall and total time to complete the orienting tasks computed for each of the six groups, yielded one significant positive correlation. This was for older adults in the self-referent condition. It is possible that the longer processing time taken by older adults can account for the finding of a lack of age differences in recall scores.

However, a time factor is not a likely explanation. A covariate analysis of variance for differences among subject groups for total free recall of stimulus phrases, with time to complete the orienting tasks as a covariate

did not yield a significant main effect of age. This suggests that when differences between younger and older adults for time to complete the orienting tasks were controlled, there were no differences between younger and older adults in free recall memory performance. Also, an analysis for differences in recall of the stimulus phrases for each of the six groups, collapsed across meaningfulness levels (i.e., phrasetypes) yielded a main effect of task. The main effect of task revealed that overall recall was lower in the spelling detection task than in the two semantic rating tasks, which did not differ in number of phrases recalled. Thus, although the spelling detection task took longer to complete, recall performance was lower in this condition. Craik and Tulving (1975) have also demonstrated that time per se is not specifically related to recall in incidental learning paradigms.

Perhaps the amount of time taken to process the stimulus phrases can account for why high meaningful phrases (i.e., phrases high in personal relevance) resulted in higher recall than low meaningful phrases (i.e., phrases low in personal relevance). It is possible that subjects spent more time processing, that is elaborating the more personally salient or relevant items in the stimulus list, at the expense of the processing of phrases low on this dimension. This is possible since the high relevance items would likely be amenable to more extensive elaborative processing, based on assumptions about differential

underlying cognitive structures for such items. Since only an overall time measure for processing stimulus phrases was obtained, it is not possible to determine on the basis of the available data, if there were differences in processing of high and low meaningful phrasetypes. However, this is a plausible hypothesis that can be tested in future studies.

Health Factor

A brief comment can be made about differences in health as measured by a five-point rating scale, between older and younger subjects in this study. The health ratings obtained from younger and older adults suggested that younger adults were in better health than older adults. However, this difference in health conditions did not seem to affect the memory performance of older, relative to younger adults as indicated by the absence of a main effect of age for overall recall of stimulus phrases. Also, the findings suggest that with the exception of one significant positive correlation for older adults in the pleasantness rating condition, health and the performance measure of total free recall seemed to be essentially unrelated for both older and younger adults.

Characteristics of Subjects and Materials Sampled in the Present Studies

The lack of age differences in recall found in this study may also be due to particular characteristics of the sample of older and younger adult subjects that were tested. The samples were quite similar in many ways. Both younger and older adults were associated with the teaching profession. Thus, familiarity and ease of working with verbal material would likely be high for both age groups. This would likely be higher than for younger and older adults in the general population. Moreover, they were probably quite familiar with the technique of elaboration which is likely employed quite frequently in their profession. Elaboration of verbal material basically seems to involve "exercising" the reader in thinking about the content (Anderson and Reder, 1979). Teachers often have to elaborate and expand upon teaching material to explain and illustrate concepts to their students.

Also, some of the particular stimulus materials employed in the present study contained self-referent content. Although no direct measure was taken, this type of material may have affected the motivation of subjects in performance of the orienting tasks. This may have been especially true for older adults who in some studies, have expressed a reluctance to deal with "nonsense" type material (Hulicka, 1965; Labouvie-Vief, 1980).

Jenkins (1979) has outlined a classification scheme that draws attention to the kinds of variables that should be considered in memory research. Four classes of variables are described. These include the nature of the subjects, the orienting tasks, the kinds of stimulus materials and the criterion tasks. Jenkins (1979) points out that the subjects' skills, abilities, knowledge, intentions and motivations could affect the manner in which they carry out the orienting tasks. These factors would seem especially important when trying to determine age-related effects on a particular performance variable. For example, most studies usually compare college students with older adults in the general population. These older adults were probably quite removed from the practice of using the academic type strategies usually employed in laboratory investigations. This could conceivably put them at a disadvantage from the very start, apart from any considerations of differences in cognitive processes.

In general, this study attempted to choose samples of subjects and materials that were comparable on these types of non-cognitive factors which, if not controlled, could conceivably account for any observed differences in memory performance between younger and older adults.

Production versus Recall

It is possible that since older and younger adults may have been aware that the content of some phrases was self-referent that at recall they generated and retrieved all possible self-referent material. This would suggest that their "memory" performance reflected more of a response bias than true memory operations such as encoding. If this were the case, then one might expect the presence of a number of extra-list items of a self-referent nature in the free recall protocols of younger and older adult subjects.

An inspection of the data revealed that there were no intrusion errors in all task conditions for both older and younger adults. This evidence does not support a response bias hypothesis, but is consistent with differences in encoding during the list-processing phase.

Conclusion

The finding that items more meaningful for a particular age group show greater recall by that age group are consistent with, and support the more general concern expressed in this study. Perhaps in previous studies involving comparisons of memory performance of younger and older adults, the stimulus items were differentially meaningful for subjects in the two age groups. If this

were the case, then older and younger adults would be presented with the same nominal, but in effect, different functional stimuli for semantic processing. If these stimuli were more meaningful for younger than older adults, the results from the current study may suggest why recall of younger adults is usually higher than that of older adults and why it is concluded that older adults are not able to process input stimuli to as deep levels as younger adults.

In conclusion, the results of this study suggest that older adults can process stimuli to deep levels. That is, they are capable of producing a semantic code that seems to be as efficient in supporting later recall as that produced by younger adults. Furthermore, the results suggest that the age-related decrements following semantic processing can be reversed under appropriate stimulus conditions.

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APPENDIX A

Lists of Phrases Presented
in Study I

High Meaningful Phrases for Older Adults(HL)

- *1. Making adjustments to cope with retirement.
- **2. Budgeting money to live on a fixed income.
- *3. Joining teams to play shuffleboard.
- 4. Participating in quilting bees to make hand crafts.
- *5. Being able to offer advice to help son or daughter.
- 6. Attending church to take part in the services.
- *7. Playing weekly bingo to maintain social activity.
- *8. Enjoying visits to see grandchildren.
- *9. Depending on pension cheques to pay household bills.
- 10. Watching television to follow the soap operas.
- 11. Fixing loose dentures to lessen the pain.
- *12. Owning a club membership to take short trips with others.
- *13. Planning meetings to play cards with a group.
- 14. Taking occasional naps to relieve tiredness.
- 15. Going to the hospital to see ailing friends.
- 16. Avoiding icy sidewalks to prevent falls.
- 17. Having difficulty following conversations.
- 18. Having to slow movements due to stiffening joints.
- *19. Taking time to care for a garden.
- *20. Receiving social security benefits to supplement finances.

*-criteria for HL category;**- criteria for HH category.

High Meaningful Phrases for Younger Adults(LH)

1. Being able to ski in the winter season.
- *2. Having campus libraries to provide reference sources.
- *3. Going for interviews to find a job after graduation.
- *4. Handing in term papers on time to avoid losing marks.
- *5. Obtaining good grades to continue education.
- **6. Exercising the body to keep good health.
7. Attending concerts to view favourite musical group.
- *8. Making careful decisions to ensure a successful career.
9. Securing student loans from government to pay living costs.
10. Attending sports matches to support school teams.
- *11. Spending adequate time to do good assignments.
- *12. Studying lecture notes to prepare for exams.
13. Having access to a counselling centre to seek help.
14. Going to pubs to have drinks with friends.
- *15. Preparing lesson plans to present to classes.
16. Listening to the stereo to enjoy music.
- *17. Learning proper way to write resumes to apply for jobs.
- *18. Practice teaching to fulfill course requirements.
19. Earning money in summer to return to classes.
20. Opposing decisions to raise tuition fees.

*-criteria for LH category;**-criteria for HH category.

High Meaningful Phrases for Younger and Older Adults(HH)

- *1. Driving a car cautiously to avoid serious injuries.
2. Wearing warm clothing to prevent colds.
- *3. Being with the family at Christmas to spend the holidays.
4. Keeping photo albums to record happy times.
- *5. Controlling weight to stay in good condition.
6. Casting a vote to have a voice in government.
- *7. Eating healthy foods to maintain good nutrition.
- *8. Having time to pursue hobbies.
9. Phoning friends to talk about latest happenings.
- *10. Being able to stay in good health.
11. Using public transportation to increase mobility.
- *12. Being with friends to celebrate birthdays.
- *13. Reading newspapers to learn about current events.
- *14. Living in a democracy to have freedom of choice.
- *15. Having courage to stand up for your own beliefs.
- *16. Being able to lead a happy life.
- *17. Striving to be honest in personal relationships.
- *18. Having opportunity to make own decisions.
19. Knowing laws help to protect citizens against criminal actions.
- *20. Getting enough sleep to feel rested during the day.

*-criteria for HH category.

Low Meaningful Phrases for Younger and Older Adults(LL)

- *1. Developing athletic ability to join the army.
 - *2. Assembling toy blocks to model familiar structures.
 - 3. Taking many pictures to develop photographic skills.
 - 4. Climbing mountains to exercise body muscles.
 - 5. Flying kites to enjoy sunny afternoons.
 - *6. Disturbing the peace to get police attention.
 - *7. Visiting the circus to see the clowns.
 - 8. Buying crayons to draw colorful pictures.
 - *9. Using skate boards to travel about the city.
 - *10. Driving a sports car to project a youthful image.
 - *11. Joining the music club to become a band member.
 - *12. Watching cartoons to pass Saturday mornings.
 - *13. Going to drive-in movies to find a romantic setting.
 - *14. Taking drama classes to provide a creative outlet.
 - *15. Going horseback riding to master the skilled art.
 - *16. Attending high school dances to see former teachers.
 - 17. Servicing own car to save some money.
 - 18. Writing letters to express dissatisfaction with consumer products.
 - 19. Donating large sums to support local charities.
 - *20. Trading comic books to get new reading material.
- *-criteria for LL category.

APPENDIX B
Instructions Presented
in Study I

Instructions

Each of you will be presented with a deck of 80 cards. On each card is a short phrase. These phrases describe a variety of situations or events.

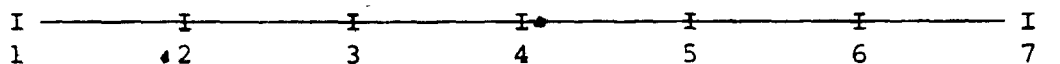
The purpose of this task is to determine how personally relevant each of these events is to you. That is, how important or significant are these events to you, generally, in terms of your current lifestyle, your interests and your concerns.

Please rate each of these phrases on a scale ranging from "1" to "7". A rating of "1" would signify that the situation or activity described by the phrase is very personally irrelevant to you. That is, it is not important or significant to you, in terms of your current lifestyle, your interests, and your concerns. A rating of "7" would signify that the situation or activity described by the phrase is very personally relevant to you. That is, it is very important or significant to you, in terms of your current lifestyle, your interests and your concerns. Please indicate your response by circling one of the numbers on the scale.

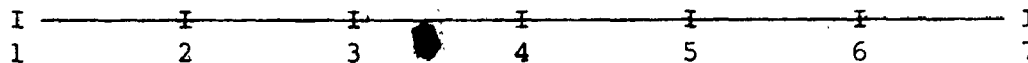
Examples: 1. Receiving pension payments to supplement other income.

Very Personally
Irrelevant

Very Personally
Relevant



2. Writing tests to fulfill course requirements.



On the sheets accompanying the deck of 80 cards are a set of 80 scales, one for each phrase. As you finish rating each phrase, please turn the card over; please make sure to match the number of the phrase as indicated on the card, with the number of the scale on the response sheet.

Thank you.

RATING SCALEVery Personally
IrrelevantVery Personally
Relevant

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

I ————— I
1 2 3 4 5 6 7

APPENDIX C

Description of the

Quick Word Test

The Quick Word Test(QWT)

The Quick Word Test, Level II(QWT, Borgatta and Corsini, 1964), was used as a measure of generalized verbal ability. It consists of 100 multiple choice items(one 5-letter stem word followed by four 4-letter alternatives) printed on a single answer sheet. Items are arranged in blocks of five with difficulty ranging from low to high within each block with approximately equal median difficulty for all blocks. Spaces are provided below each alternative for indicating choice. The following is a sample of items:

1. taper leer wick work bind
2. shoot bang push twig jump
3. storm wild wash rend rave
4. fatal dire evil omen wish
5. foray food wood take raid

Directions:

Fill in the answer space for the word that means the same as the first word. If you do not know, GUESS. Work quickly... ANSWER ALL THE QUESTIONS.

sample: happy dull seem glad fast

The QWT was selected for use in this study because of the simplicity of its format. Extensive norms have been developed for this test for sex, education level and occupational groups. However, age norms are not available. This is a test that is a convergent or "intellective" measure, representing a measure of "general" ability (Borgatta and Corsini, 1964).

APPENDIX D

List of Stimulus Phrases Presented
in Study II in the Semantic
Self-Referent and Pleasantness
Rating Tasks

Stimulus Phrases Presented in the Self-Referent and Pleasantness Rating Tasks

1. Exercising the body to keep good health.
2. Learning proper way to write resumes to apply for jobs.
3. Taking drama classes to provide a creative outlet.
4. Planning meetings to play cards with a group.
5. Joining the music club to become a band member.
6. Developing athletic ability to join the army.
7. Having campus libraries to provide reference sources.
8. Going for interviews to find a job after graduation.
9. Visiting the circus to see the clowns.
10. Depending on pension cheques to pay household bills.
11. Having courage to stand up for own beliefs.
12. Living in a democracy to have freedom of choice.
13. Eating healthy foods to maintain good nutrition.
14. Taking time to care for a garden.
15. Being able to lead a happy life.
16. Reading newspapers to learn about current events.
17. Trading comic books to get new reading materials.
18. Studying lecture notes to prepare for exams.
19. Driving a car cautiously to avoid serious injuries.
20. Spending adequate time to do good assignments.

21. Making careful decisions to ensure a successful career.
22. Being able to stay in good health.
23. Striving to be honest in personal relationships.
24. Owning a club membership to take short trips with others.
25. Receiving social security benefits to supplement finances.
26. Driving a sports car to project a youthful image.
27. Enjoying visits to see grandchildren.
28. Preparing lesson plans to present to classes.
29. Playing weekly bingo to maintain social activity.
30. Obtaining good grades to continue education.
31. Making adjustments to cope with retirement.
32. Assembling toy blocks to model familiar structures .
33. Disturbing the peace to get police attention.
34. Practice teaching to fulfill course requirements.
35. Using skate boards to travel about the city.
36. Joining teams to play shuffleboard.
37. Budgeting money to live on a fixed income.
38. Handing in term papers on time to avoid losing marks.
39. Going horseback riding to master the skilled art.
40. Being able to offer advice to help son or daughter.

APPENDIX E

Instructions Presented in the Self-Referent Rating Task

Instructions

Each of you will be presented with a deck of cards. On each card is a short phrase. These phrases describe a variety of situations or events.

The purpose of this task is to determine how personally relevant each of these events is to you. That is, how important or significant are these events to you, generally, in terms of your current lifestyle, your interests and your concerns.

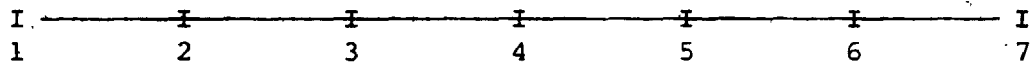
Please rate each of these phrases on a scale ranging from "1" to "7". A rating of "1" would signify that the situation or activity described by the phrase is very personally irrelevant to you. That is, it is not important or significant to you, in terms of your current lifestyle, your interests, and your concerns. A rating of "7" would signify that the situation or activity described by the phrase is very personally relevant to you. That is, it is very important or significant to you, in terms of your current lifestyle, your interests and your concerns.

Please indicate your response by circling one of the numbers on the scale.

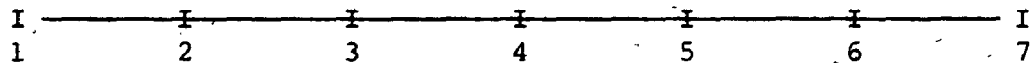
Examples: 1. Writing tests to fulfill course requirements.

Very Personally
Irrelevant

Very Personally
Relevant



2. Receiving pension payments to supplement other income.



On the sheets accompanying the deck of cards are a set of scales, one for each phrase. As you finish rating each phrase, please turn the card over; please make sure to match the number of the phrase as indicated on the card, with the number of the scale on the response sheet.

Thank you.

APPENDIX F

Instructions Presented in the Pleasantness Rating Task

Instructions

Each of you will be presented with a deck of cards. On each card is a short phrase. These phrases describe a variety of situations or events.

The purpose of the task is to determine how pleasant each of the events is to you. Please rate each of these phrases on a scale ranging from "1" to "7". A rating of "1" would signify that the situation or activity described by the phrase is very unpleasant to you. A rating of "7" would signify that the situation or activity described by the phrase is very pleasant to you. Please indicate your response by circling one of the numbers on the scale.

On the sheets accompanying the deck of cards are a set of scales, one for each phrase. As you finish rating each phrase, please turn the card over; please make sure to match the number of the phrase as indicated on the card, with the number of the scale on the response sheet.

Thank you.

APPENDIX G

Instructions Presented in the

Spelling Detection Task

Instructions

Each of you will be presented with a deck of cards. On each card is a short phrase. These phrases describe a variety of situations or events.

The purpose of this task is to determine how well you can detect spelling errors in each of the phrases. Please read through each phrase very carefully checking for the correct spelling of each word. The task is to determine the number of words spelled incorrectly in each phrase.

Please indicate your response by writing a number, which reflects the number of words spelled incorrectly, on the line beside the appropriately numbered phrase, on the answer sheet. If for example, you find no spelling errors in a phrase, you would indicate this by putting a "0" on the line beside that phrase, on the answer sheet. If you find one spelling error, the response would be "1", etc. In addition, please write down, on the answer sheet, the word or words which you find are spelled incorrectly, beside the appropriate phrase number on the answer sheet.

As you finish reading each phrase, and have checked for spelling errors, please turn the card over; please make sure to match the number of the phrase as indicated on the card, with the corresponding number of the phrase on the answer sheet.

Thank you.

APPENDIX H

List of Stimulus Phrases Presented
in Study II in the Structural
Spelling Detection Task

Stimulus Phrases for Spelling Detection Task

1. Exercising the body to keep good health.
2. Learning proper way to write resumes to apply for jobs.
3. Taking drama classes to provide a creative outlet.
4. Planning meetings to play cards with a group.
5. Joining the music club to become a band member.
6. Developing athletic ability to join the army.
7. Having campus libraries to provide reference sources.
8. Going for interviews to find a job after graduation.
9. Visiting the circus to see the clowns.
10. Depending on pension cheques to pay household bills.
11. Having courage to stand up for own beliefs.
12. Living in a democracy to have freedom of choice.
13. Eating healthy foods to maintain good nutrition.
14. Taking time to care for a garden.
15. Being able to lead a happy life.
16. Reading newspapers to learn about current events.
17. Trading comic books to get new reading material.
18. Studying lecture notes to prepare for exams.
19. Driving a car cautiously to avoid serious injuries.
20. Spending adequate time to do good assignments.

21. Making careful decisions to ensure a successful career.
22. Being able to stay in good health.
23. Striving to be honest in personal relationships.
24. Owning a club membership to take short trips with others.
25. Receiving social security benefits to supplement finances.
26. Driving a sports car to project a youthful image.
27. Enjoying visits to see grandchildren.
28. Preparing lesson plans to present to classes.
29. Playing weekly bingo to maintain social activity.
30. Obtaining good grades to continue education.
31. Making adjustments to cope with retirement.
32. Assembling toy blocks to model familiar structures.
33. Disturbing the peace to get police attention.
34. Practice teaching to fulfill course requirements.
35. Using skate boards to travel about the city.
36. Joining teams to play shuffleboard.
37. Budgeting money to live on a fixed income.
38. Handing in term papers on time to avoid losing marks.
39. Going horseback riding to master the skilled art.
40. Being able to offer advice to son or daughter.

APPENDIX I

Free Recall Instructions

Presented in Study II

Instructions

Please write down in the following response booklet, all the phrases that you read on the cards. The phrases can be written down in any order that you wish. Try to give the exact wording of the phrases.

You are also encouraged to guess at phrases, and to write down any part or parts of, phrases that you can remember.

Thank you.

APPENDIX J

Comparison of Mean Ratings
of Stimulus Phrases Obtained
in Studies I and II
from Younger and Older Adults

(a) Comparison of Mean Ratings of Stimulus Phrases Obtained
in Study I and Study II from Younger Adults

Phrase	Mean Ratings		
	Study I ^a	Study II ^b	"t"
1. Joining the music club to become a band member.	1.37	1.31	0.25
2. Developing athletic ability to join the army.	1.07	1.19	0.84
3. Having campus libraries to provide reference sources.	6.07	6.63	-2.25*
4. Going to interviews to find a job after graduation.	6.83	6.88	0.27
5. Visiting the circus to see the clowns.	1.80	1.13	3.19*
6. Depending on pension cheques to pay household bills.	1.20	1.13	0.54
7. Having courage to stand up for own beliefs.	6.23	6.44	-0.77
8. Living in a democracy to have freedom of choice.	6.00	6.75	-2.56*
9. Eating healthy foods to maintain good nutrition.	6.20	6.38	-0.67
10. Taking time to care for a garden.	2.00	1.25	2.98*
11. Being able to lead a happy life.	6.53	6.81	-1.55
12. Reading newspapers to learn about current events.	6.00	6.38	-1.59
13. Trading comic books to get new reading materials.	1.07	1.13	-0.60
14. Studying lecture notes to prepare for exams.	6.07	6.63	-2.44*
15. Driving a car cautiously to avoid serious injuries.	6.17	6.56	-1.49

Phrase	Mean Ratings		
	Study I ^a	Study II ^b	"t"
16. Spending adequate time to do good assignments.	6.00	6.44	-1.73
17. Making careful decisions to ensure a successful career.	6.43	6.69	-1.25
18. Being able to stay in good health.	6.57	6.88	-2.17*
19. Striving to be honest in personal relationships.	6.60	6.81	-1.02
20. Owning a club membership to take short trips with others.	1.97	1.56	1.23
21. Receiving social security benefits to supplement finances.	1.47	1.13	1.69
22. Driving a sports care to project a youthful image.	1.57	1.50	0.27
23. Enjoying visits to see grandchildren.	1.40	1.00	1.93
24. Preparing lesson plans to present to classes.	6.43	6.69	-1.33
25. Playing weekly bingo to maintain social activity.	1.07	1.00	1.46
26. Obtaining good grades to continue education.	6.07	6.38	-1.36
27. Making adjustments to cope with retirement.	1.10	1.06	0.38
28. Assembling toy blocks to model familiar structures.	1.30	1.13	1.20
29. Disturbing the peace to get police attention.	1.03	1.06	0.42
30. Practice teaching to fulfill course requirements.	6.60	6.88	-1.84
31. Using skate boards to travel about the city.	1.03	1.00	1.00

Phrase	Mean Ratings		
	Study I ^a	Study II ^b	"t"
32. Joining teams to play shuffleboard.	1.30	1.00	1.96

^aBased on \underline{n} = 30 subjects.

^bBased on \underline{n} = 16 subjects.

* \underline{p} < .05.

(b) Comparison of Mean Ratings of Stimulus Phrases Obtained in Study I and Study II from Older Adults

Phrase	Mean Ratings		
	Study I ^a	Study II ^b	"t"
1. Joining the music club to become a band member.	1.00	1.31	2.07*
2. Developing athletic ability to join the army.	1.13	1.06	0.48
3. Having campus libraries to provide reference sources.	1.73	1.81	0.25
4. Going to interviews to find a job after graduation.	1.37	1.00	1.43
5. Visiting the circus to see the clowns.	1.40	1.50	-0.33
6. Depending on pension cheques to pay household bills.	6.03	6.75	-2.43*
7. Having courage to stand up for own beliefs.	6.57	6.50	0.30
8. Living in a democracy to have freedom of choice.	6.73	6.88	0.93
9. Eating healthy foods to maintain good nutrition.	6.40	6.63	0.88
10. Taking time to care for a garden.	6.13	6.69	-2.66*
11. Being able to lead a happy life.	6.80	6.56	1.27
12. Reading newspapers to learn about current events.	6.53	6.38	0.67
13. Trading comic books to get new reading materials.	1.00	1.00	0.00
14. Studying lecture notes to prepare for exams.	1.17	1.06	0.09
15. Driving a car cautiously to avoid serious injuries.	6.67	6.75	-0.48
16. Spending adequate time to do good assignments.	1.60	1.69	-0.30

Phrase	Mean Ratings		
	Study I ^a	Study II ^b	"t"
17. Making careful decisions to ensure a successful career.	1.97	1.44	1.47
18. Being able to stay in good health.	6.97	6.69	1.66
19. Striving to be honest in personal relationships.	6.83	6.75	0.45
20. Owning a club membership to take short trips with others.	6.23	6.38	-0.58
21. Receiving social security benefits to supplement finances.	6.30	6.50	-0.83
22. Driving a sports car to project a youthful image.	1.20	1.31	-0.52
23. Enjoying visits to see grandchildren.	6.43	6.69	-0.22
24. Preparing lesson plans to present to classes.	1.57	1.13	1.66
25. Playing weekly bingo to maintain social activity.	6.60	5.25	5.14*
26. Obtaining good grades to continue education.	1.13	1.13	0.23
27. Making adjustments to cope with retirement.	6.27	6.69	-1.51
28. Assembling toy blocks to model familiar structures.	1.10	1.13	-0.19
29. Disturbing the peace to get police attention.	1.00	1.00	0.00
30. Practice teaching to fulfill course requirements.	1.20	1.00	1.18
31. Using skate boards to travel about the city.	1.00	1.00	0.00
32. Joining teams to play shuffleboard.	6.37	5.88	2.23*

^aBased on n = 30 subjects.

^bBased on n = 16 subjects.

* $p < .05$.

APPENDIX K

Analysis of Variance Summary Tables for
Education and Vocabulary Test Scores

(a) Analysis of Variance of Education Level

Source	SS	df	MS	F
A (Age)	6.60	1	6.00	3.59
T (Task)	9.08	2	4.54	2.72
AT	.25	2	.13	.08
Subjects Within Groups	150.50	90	1.67	

$p > .05.$

(b) Analysis of Variance of Vocabulary Scores

Source	SS	df	MS	F
A (Age)	368.17	1	368.17	11.26*
T (Task)	7.15	2	3.57	.11
AT	8.40	2	4.20	.13
Subjects Within Groups	2944.13	90	32.71	

* $p < .001.$

APPENDIX L

Analysis of Variance Summary Table for
Recall Scores

Analysis of Variance of Recall Scores by Age Level,
Task Condition, Sex and Phrasetype

Source	SS	df	MS	F
Between subjects	385.00	95		
A (Age)	4.82	1	4.82	3.61
T (Task)	264.40	2	132.20	99.07*
S (Sex)	.00	1	.00	.00
AT	.33	2	.17	.12
AS	.21	1	.21	.16
TS	.08	2	.04	.03
ATS	3.06	2	1.53	1.15
Subjects Within Groups	112.09	84	1.33	
Within Subjects	1729.25	288		
M (Meaningfulness of Phrasetypes)	279.28	3	93.09	65.66*
MA	804.47	3	268.16	189.14*
MT	88.10	6	14.68	10.36*
MS	4.65	3	1.55	1.09
MAT	174.67	6	29.11	20.53*
MAS	3.20	3	1.07	.75
MTS	1.66	6	.28	.20
MATS	15.94	6	2.66	1.87
M x Subjects Within Groups	357.28	252	1.42	

*p < .01.

APPENDIX M

Summary Tables of the
Simple Effects of
Recall Scores

(a) Age by Meaningfulness Simple Interaction Effects
at Each Level of Task

Source	SS	df	MS	F
A ^a by M ^b at t1 ^c	516.27	3	172.09	121.40*
A by M at t2	427.65	3	142.55	100.56*
A by M at t3	35.21	3	11.74	8.28*
M x Subjects Within Groups	382.73	270	1.42	

(b) Simple Main Effects: Age Differences in Recall
at Each Level of Meaningfulness and Task

Between A at HH ^d at t1	4.50	1	4.50	3.25
Between A at HL at	253.13	1	253.13	182.91*
Between A at LH at t1	258.78	1	258.78	187.00*
Between A at LL at t1	.50	1	.50	.36
Between A at HH at t2	.13	1	.13	.90
Between A at HL at t2	190.13	1	190.13	137.39*
Between A at LH at t2	236.53	1	236.53	170.92*
Between A at LL at t2	3.13	1	3.13	2.26
Between A at HH at t3	.03	1	.03	.02
Between A at HL at t3	9.03	1	9.03	6.53*
Between A at LH at t3	28.13	1	28.13	20.32*
Between A at LL at t3	.28	1	.28	.20
Error Term		360	1.38	

^aA - age level.

^bM - meaningfulness of phrasetypes.

^ct1 - self-referent rating task.

t2 - pleasantness rating task.

t3 - spelling detection task.

^dHH - high meaningful phrases for older and younger adults.

HL - high meaningful phrases for older adults, low in meaningfulness for younger adults.

LH - high meaningful phrases for younger adults, low meaningfulness for older adults.

LL - low meaningful phrases for older and younger adults.

*p < .05.

(c) Task by Meaningfulness Simple Interaction Effects
at Each Level of Age

Source	SS	df	MS	F
T ^a by M ^b at a1 ^c	110.80	6	18.47	13.03*
T by M at a2	151.97	6	25.33	17.87*
M x Subjects Within Groups	382.73	270	1.42	

(d) Simple Simple Main Effects: Task Differences
in Recall at Each Level of Meaningfulness and Age

Among T at HH ^d at a1	101.17	2	50.58	36.55*
Among T at HL at a1	2.17	2	1.08	.78
Among T at LH at a1	131.17	2	65.58	47.39*
Among T at LL at a1	4.88	2	2.44	1.76
Among T at HH at a2	86.38	2	43.19	31.21*
Among T at HL at a2	198.88	2	99.44	71.86*
Among T at LH at a2	2.38	2	1.19	.86
Among T at LL at a2	.50	2	.25	.18
Error Term		360	1.38	

^aT - task condition.

^bM - meaningfulness of phrasetypes.

^ca1 - younger adults.

a2 - older adults.

^dHH - high meaningful phrases for older and younger adults.

HL - high meaningful phrases for older adults, low in
meaningfulness for younger adults.

LH - high meaningful phrases for younger adults, low in
meaningfulness for older adults.

LL - low meaningful phrases for older and younger adults.

* $p < .05$.

APPENDIX N

Analysis of Variance Summary Table
for Time to Complete Orienting Tasks

Analysis of Variance of Time to Complete Orienting Tasks

Source	SS	df	MS	F
A (Age)	34694.01	1	34694.01	7.24*
T (Task)	226377.08	2	113188.54	23.63**
AT	12033.33	2	6016.67	1.26
Subjects Within Groups	431170.31	90	4790.78	

* $p < .01$.

** $p < .001$.

END

0 7 10 9 18 4

FIN